The Welding Engineer

Edited by L. B. Mackenzie

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ANYTHING AND EVERYTHING
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Some day you'll find this man in your plant

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Cone length is often considered a measure of the heat or power of the flame but in reality it is a measure of poorness of the mixture and purity of the gases and the hardness of the flame, or a combination of these three things, all of which contribute to poor welds.

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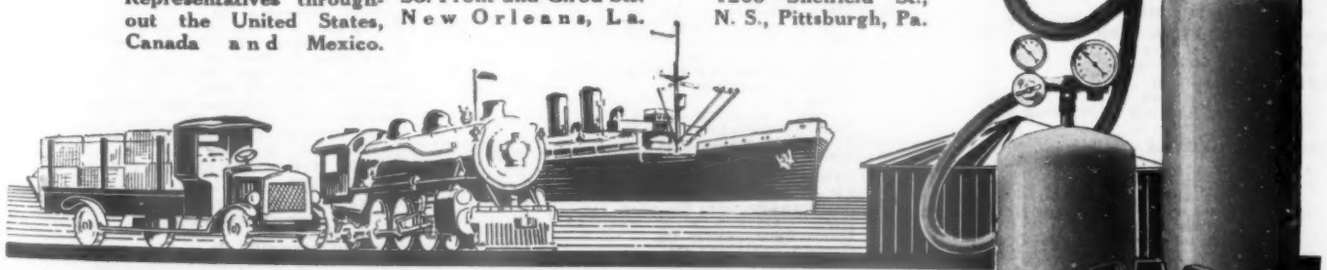

WELDING PUROX CUTTING

Buyers' Index

Readers of The Welding Engineer will find this index to contain the most accurate information obtainable relating to welding apparatus and supplies. The advertising section includes the principal manufacturers of the United States.

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See "Torches"

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The Welding Engineer
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U. S. Welding Co.
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See "Torches"

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Muskegon — Michigan Oxy-Hydric Co.

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Omaha—The Balbach Co.

NEVADA

Reno — California Compressed Gas Co.

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Cleveland—Clarke Chemical Co.
Columbus—Gas Products Co.
Niles—Ohio Oxygen Co.
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Oklahoma City — Burdett Oxygen Co. of Oklahoma City
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Pittsburgh — Burdett Oxygen & Hydrogen Co.
Verona — International Oxygen Co.

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Knoxville — Burdett Oxygen Co. and the Kentucky Oxygen-Hydrogen Co.
Memphis — Memphis Oxygen Co.
Nashville — Burdett Oxygen Co. and Kentucky Oxygen-Hydrogen Co.

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Ranger — Burdett Oxygen Co. of Texas
Waco—Burdett Oxygen Co. of Texas
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Houston — Magnolia Gas Products Co.
San Antonio—Magnolia Gas Products Co.

UTAH

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Ogden — Utah Compressed Gas Co.

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WASHINGTON

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Everett — Washington Compressed Gas Co.
Seattle — Washington Compressed Gas Co.
Tacoma—Washington Compressed Gas Co.

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Fond du Lac — Universal Oxygen Co.
Green Bay—Universal Oxygen Co.
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Madison — Universal Oxygen Co.
Manitowoc—Universal Oxygen Co.
Milwaukee—Universal Oxygen Co.
Sheboygan — Universal Oxygen Co.

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Chicago Steel & Wire Co.
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Modern Engineering Co.
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Oxweld Acetylene Co.
Purox Co.
Page Steel & Wire Co.
Superior Oxy-Acetylene Machine Co.
Transportation Engineering Corp.

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Burdett Oxygen Co.
Central Steel & Wire Co.
Bierman-Everett Fdy. Co.
Carbic Mfg. Co.
Davis-Bournonville Co.
International Oxygen Co.
The Imperial Brass Mfg. Co.
Modern Engineering Co.
Oxweld Acetylene Co.
Purox Co.
Page Steel & Wire Co.
Superior Oxy-Acetylene Machine Co.
Torchweld Equipment Co.
United States Welding Co.

FILLER RODS (Vanadium Steel)
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Bierman-Everett Fdy. Co.
Carbic Mfg. Co.
Central Steel & Wire Co.
Universal Oxygen Co.
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Davis-Bournonville Co.
International Oxygen Co.
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Reid-Avery Co.
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International Oxygen Co.
Imperial Brass Mfg. Co.
Purox Co.
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Purox Co.
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Oxweld Acetylene Co.
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Smith's Inventions, Inc.
Superior Oxy-Acetylene Machine Co.
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Davis-Bournonville Co.
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Imperial Brass Mfg. Co.
Modern Engineering Co.
Oxweld Acetylene Co.
Purox Co.
Smith's Inventions, Inc.
Superior Oxy-Acetylene Machine Co.
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Harris Calorific Co.
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K-G Welding & Cutting Co.
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Purox Co.
Smith's Inventions, Inc.
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Modern Engineering Co.
Oxweld Acetylene Co.
Purox Co.
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Gas Products Ass'n.
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Purox Co.

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Oxweld Acetylene Co.
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Alexander Milburn Co.
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Oxweld Acetylene Co.
Purox Co.
Superior Oxy-Acetylene Machine Co.
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Torchweld Equipment Co.
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International Oxygen Co.
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Harris Calorific Co.
International Oxygen Co.
The Imperial Brass Mfg. Co.
K-G Welding & Cutting Co.
Metals Welding Co.
Alexander Milburn Co.
Modern Engineering Co.
Oxweld Acetylene Co.
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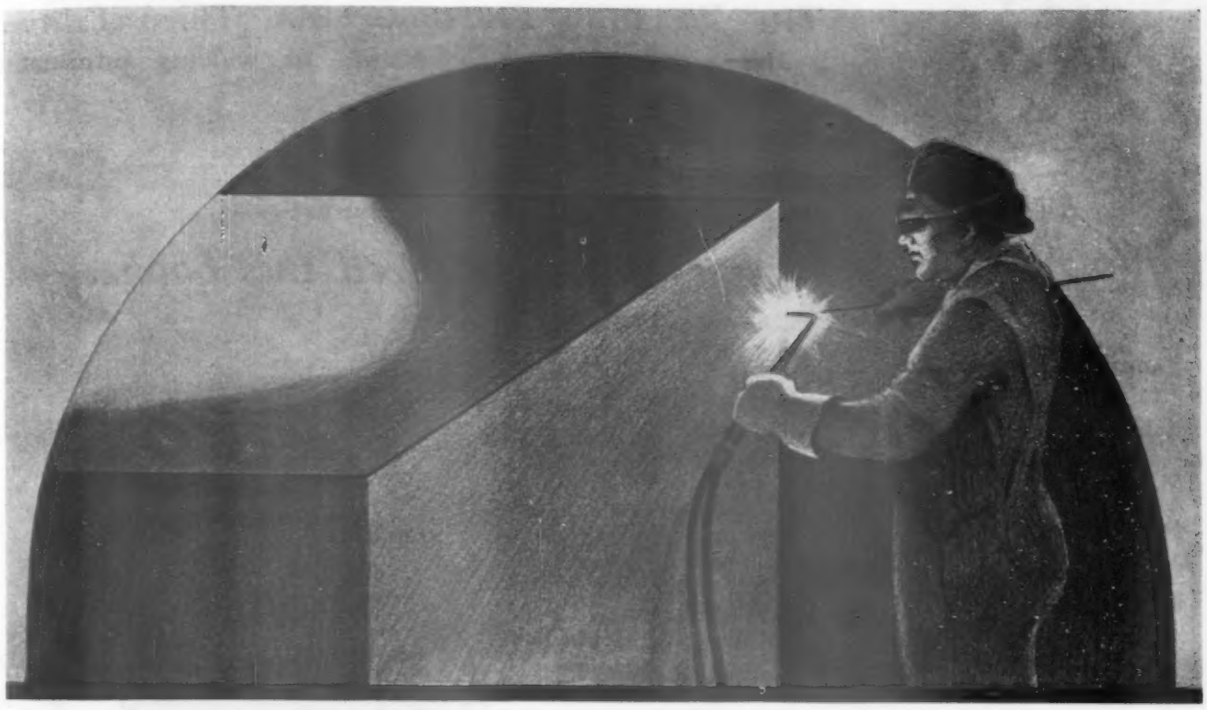

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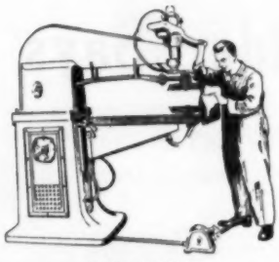

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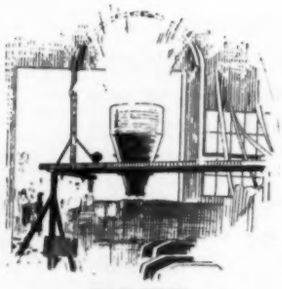

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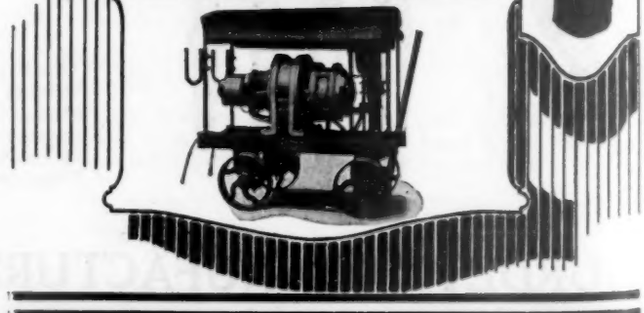

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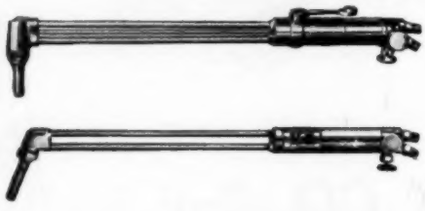

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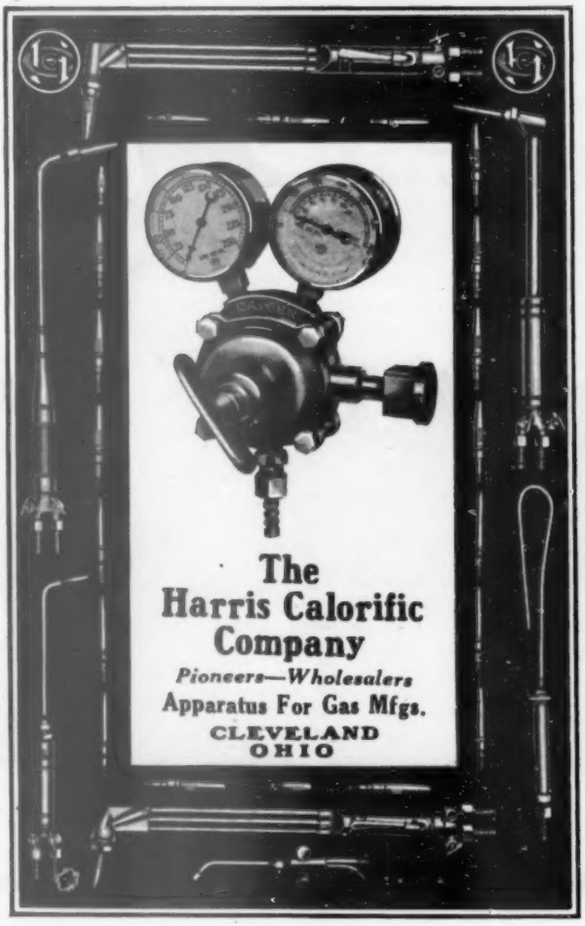

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EXPANSION IN IRON CASTINGS

How the Distribution of Mass in the Casting Determines the Correct Procedure in Preheating

By D. Richardson*

CAST iron welding has reached such a degree of perfection that it can be truly stated that misapplication, or ignorance of the essential principles is responsible for the failures and defects so frequently encountered. With regard to repairs on cast iron, the value of the expert welder is not measured by his skillful handling of the blowpipe, but depends very largely on his preliminary study of the expansion and contraction effects which the casting will undergo, and his method of dealing with them so as to avoid fractures during and after the welding operation.

It is true that the principles which have been laid down for the repair of castings, and especially those dealing with preheating

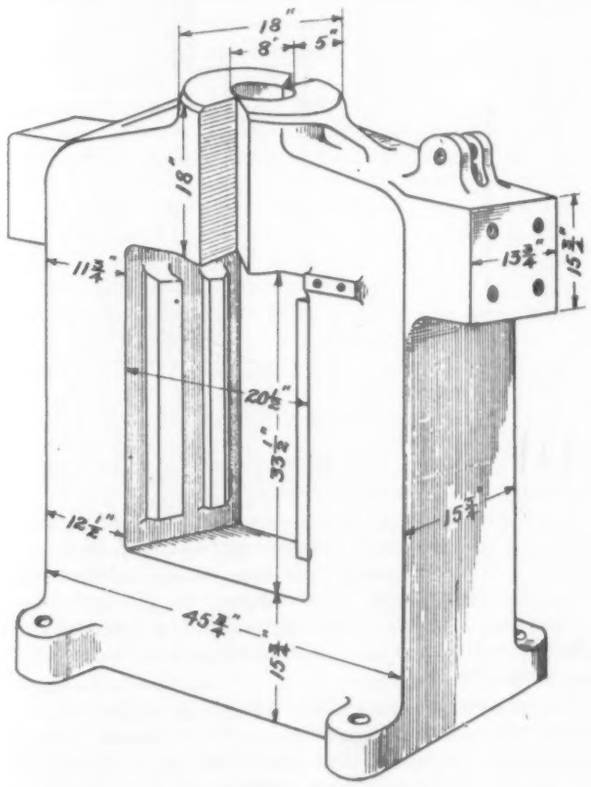

Figure 1.

devices and methods, enable welders to obtain success in the majority of cases which they handle. Now and again exceptions arise which do not fall in the usual routine and such is the case when dealing with comparatively small but very heavy castings. A recent issue of the *Revue de la Soudure Autogéne* directs attention to what they term a new factor, which intervenes in repairs of the type mentioned, namely, the influence of mass, which brings about difficulties in their execution, difficulties of manipulation, inequalities in temperature and consequently variation in expansion effects which lack of elasticity in the metal adds to the difficulties.

In the article mentioned a typical example of the difficulties encountered in repairing massive castings is given by taking the case of a repair to the frame of a large press, the dimensions of which are given in Fig. 1, and also the position of the fractures, prepared for welding.

The first method of repair shown in Fig. 2 is clearly defective. The welder in this case has surrounded the parts A and B by a built up preheating furnace and after preheating has welded without any further precautions. To operate under these conditions makes the assumption that fractures on cooling are unlikely, and the only object of preheating is to add a considerable quantity of heat in advance and during the welding operation.

The disadvantage of this method of procedure is easily recognized. Briefly, preheating before welding will expand the two chamfered portions and as a result they will approach each other as shown by the arrows. It is clear that after the welding operation these expanded portions will contract and to this contraction must be added that of the large molten zone of the weld. In such a case a fracture of the weld or in its surrounding parts can be anticipated. In certain cases and under certain conditions, as, for example, if the casting has a certain degree of elasticity, a fracture may not take place, but the residual stresses will be so high that subsequent failure under shocks or increased strain is very probable.

The problem was next handed over to a more experienced welder and according to the recognized theories for such work it will be necessary to preheat the casting in such a manner as to cause the chamfered edges to separate, that is to say, it will be necessary to heat the portion shown hatched in Fig. 3. This idea is obviously rational, but in this case the repair will have to be considered an exception to the recognized rule, because of the very great influence of the mass. It will probably be found that if the repair is carried out on this basis that a failure is still the result. The failure can be explained in the following manner: If the importance of beveling throughout the thickness and length of the weld is considered, it is clear that if the weld is made in a horizontal position, the first portions welded will not remain at the same temperature as subsequent portions which are in fusion, consequently, the early portions welded undergo contraction effects which tend to close the extremeties of the line of welding and produce internal stresses in the weld. This tendency for the edges to approach is, in the case of cast iron, analogous to that considered in welding steel plates, where one separates them in the form of a V in advance. In short welds, or where the welds can be made rapidly by two operators and which therefore remain practically at the same temperature throughout their length, this phenomenon can be ignored, as the contraction is almost the same at both extremeties, so that one can say that the rejoined edges are parallel. But this is not the case in the repair under consideration, by reason, first, of the length of the weld and the necessity of turning the casting in the fire.

The difficulties which are presented in turning a mass like this weighing about 5 tons both in manœuvering and managing the operation, but mainly from the point of view of avoiding setting up strains as a result of the differences in temperature between the parts welded and those which are attacked after turning are fairly obvious

The following is the correct method of carrying out this repair and the reasons for adopting different methods than those indicated in the two previous methods.

The casting is heated at the part indicated in Fig. 4 in such a manner as to produce expansion of the lower portion. The expansion being much greater in the neighborhood of the press table than in the base of the casing which is kept intentionally at a comparatively low temperature. This expansion has the effect of Veeing the beveled edges of the weld, the movement of the sides being indicated by the chain-dotted lines. The V is, of course, very small and necessitates carrying out the welds in a vertical position, two welders working simultaneously on each

*Editor, *Acetylene and Welding Journal*, London.

beveled portion. It is understood that vertical welds on cast iron are made by superimposing one bath on another, making use of carbon blocks or paste to keep the metal in position.

A welder, who, after consideration, adopted this method of repairing the casting could be classed as an expert welder and would show by his reasoning and ability to tackle the vertical weld his right to be considered a first class repairer. The method indicated avoids manipulating the casting in the fire, always a troublesome operation accompanied by the risk of obtaining irregular temperatures and distortion; on the other hand, the two welds are carried out in the same manner and at the same time, and the welded portions are thus at identical temperatures at all periods of the welding operation.

In addition, the separation of the beveled edges in the form of a V by the special arrangement of the preheating, is a great advantage; by gradually diminishing the temperature of the preheating furnace, and consequently that of the part preheated, the arms of the press gradually approach each other. This angular approach, as it can be called, compensates for the contraction in the weld which, as previously explained, is much greater at the conclusion, than at the commencement of the welding operation.

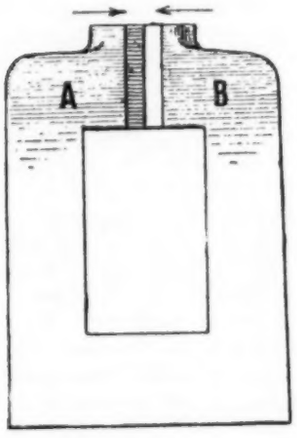

Figure 2.

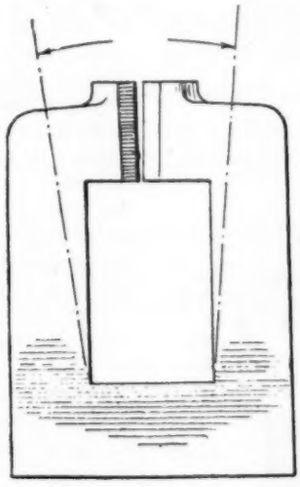

Figure 3.

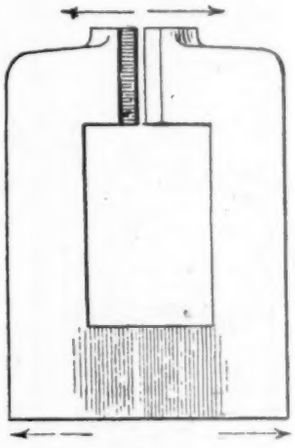

Figure 4.

The complete success of this method shows that it is correct and superior from all points of view, and as the press, after being out of service for several months, has now been in use for a considerable time without any sign of faiure, the need for the consideration of the influence of mass in welding castings is demonstrated.

LIQUID AIR AND OXY-ACETYLENE WELDING DEMONSTRATION AT ELM VOCATIONAL SCHOOL

The industrial wonders of Oxygen were shown by motion pictures, lecture and demonstration at the Elm Vocational School, Buffalo, New York, on January 9. The program, which was arranged by the Elm Vocational School assisted by the Air Reduction Sales Company was of unusual interest to men interested in the remarkable accomplishment of the oxy-acetylene welding and cutting process.

Mr. William B. Kamprath, Principal of the Elm Vocational School, greeted representatives of various industrial plants throughout Buffalo who assembled to take advantage of the entertaining and instructive program provided. Mr. Kamprath then introduced Mr. G. E. Harcke for a short lecture on the oxy-acetylene process.

Mr. Harcke has had a wide experience in training men in the use of the oxy-acetylene welding and cutting torches. His ability to lecture on interesting phases of welding and cutting practice has resulted in a constant demand from engineering and industrial organizations throughout the country to talk before their members.

Following Mr. Harcke's lecture on the oxy-acetylene process, Mr. G. Van Alstyne of the Air Reduction Sales Company was introduced. Mr. Van Alstyne showed the properties of liquid oxygen by actual demonstrations of this liquid oxygen on various substances. Liquid oxygen has a temperature of approximately 300 degrees below zero, Fahrenheit. It will freeze fruit, flowers, rubber, zinc, mercury, etc., and the demonstration showed in an entertaining way the transformation that takes place when such articles are immersed in the liquid oxygen.

The oxygen used for the demonstration was taken from the Buffalo plant of the Air Reduction Sales Company, one of the Twenty-two Airco Oxygen Plants extending from coast to coast in the principal industrial centers. The Buffalo plant is in the Buffalo District of the Company, which is in charge of Mr. P. W. Kromer, District Manager.

In the Air Reduction Plants oxygen is produced from the air by the Claude process. This process, described as briefly and simply as possible, is one that liquefies the air and then separates the oxygen from nitrogen by boiling off the nitrogen, thus leaving the pure oxygen. The oxygen liquid is then permitted to evaporate and the oxygen gas is compressed in the steel cylinders used in industry.

Following the demonstration of liquid oxygen the motion picture, "Oxygen the Wonder Worker" was shown. This picture was produced by the United States Bureau of Mines with the Air Reduction Sales Company cooperating.

This film shows how liquid air is made; why it is possible to separate the gases of the atmosphere; how oxygen is extracted from the air; how the high temperature (6300 degrees F.) of the oxy-acetylene flame is produced; how carbide is made and acetylene gas generated; how iron, steel, copper, brass, aluminum and other metals are welded; how steel and cast iron are cut; how the oxy-acetylene torch is adapted to mechanical cutting and welding; and how welding and cutting operations of great economical value are performed in some of the country's important industrial plants and railroad shops.

The spectacular and fascinating character of the scenes showing the cutting and welding operations, augments the interest surrounding those showing the production of oxygen and other welding and cutting products, and gives to the film an attraction held by few other industrial motion pictures. In addition there is an underlying theme to "Oxygen the Wonder Worker" that tells a story of interest to the engineer, a story of metallurgy, of correct principles and efficient practice, and of new developments in the welding and cutting industry that are designed to reduce costs and increase production.

FLUXES AND THEIR FUNCTIONS*

Comparison of the Use of Fluxes in Steel Manufacture to Their Use in Metallic Arc Welding of Iron and Steel

By James Caldwell†

What Is a Weld?

A WELD is a junction surface or zone between portions of metal which were separate, but have become by the welding process one homogeneous body.

A weld is perfect if in every section across it extending into the previously separate portions there is nothing but metal of uniform character, *i.e.*, no inclusion of any other substance, solid, liquid or gaseous.

Soldering is distinguished from welding by the fact that a metal or alloy of different composition is introduced between the main portions which it is desired to unite, so that a section across a soldered joint displays a zone or zones within which the metal is different from that of the original pieces.

This definition of a weld as distinguished from a soldering implies that the originally separate pieces were of the same description. It may be extended to the case of welds between pieces of different descriptions by the condition that a cross section should show a transition from the one to the other more or less sharp, but without the inclusion of any other substance, though there will be in such a weld a zone where the original materials have mixed or combined.

The microscope shows that in a good weld the crystal grains of the separate portions have interlocked either with each other or with grains of a mixture or combination of both. That is, the union across the weld is of the same intimate character as that between the crystal grains of a solid piece of metal. If the separate pieces were of the same description it should not be possible to distinguish any sharp line of transition.

The structural character of a weld is well shown by a section across a weld between two metals which do not alloy, say brass and iron. The microscope shows that brass grains interpenetrate between the iron grains, and iron grains interpenetrate between the brass grains (crystals). They interlock like the portions of a jig-saw puzzle when properly assembled.

This definition of a weld by its structure does not limit the methods by which it is produced. The intimate union which it implies may be brought about by fusion, when the contiguous liquid portions intermingle, or by pressure, when the contiguous surfaces are sufficiently plastic to allow of the pressure forcing the surface grains into intimate contact. In practice heating to the fusing point, or to a temperature near the point at which the metal is plastic, is a part of every welding process.

Smith's Welds

Wrought iron is the metal in which the welding property was probably first utilized. So far as we know, the earliest extraction of iron from its ores was effected by methods which reduced the iron, without melting it, to a spongy mass of plastic iron mingled with slag and ash, which was solidified by hammering, driving out the liquid slag and welding the particles of hot iron together into a quasi-homogeneous ball or bar. From this to the welding of these together to form a larger mass was an obvious step. The smith's weld is therefore a survival of the earliest iron metallurgy.

The property of welding under the hammer when at a proper temperature is mainly due to the fact that the layer of oxide which forms on an iron surface heated in the presence of air melts at a lower temperature than does the iron itself.

Under the hammer blows, the liquid oxide is driven out and the clean surfaces of hot iron are forced into contact so intimate that the grain interlocking occurs.

The molten skin of oxide protects the iron from further oxidation, but is so fluid that it flows away under the pressure. It is a natural flux.

(It should be noted that cast-iron cannot be welded under the hammer, because the oxide is solid at the melting point of cast-iron; it is the iron that squeezes out under the hammer blows; the solid oxide prevents union.)

But the melting point of iron oxide is not so very much below that of the wrought iron, and as soon as the piece cools below that point the solid oxide prevents metallic contact. Hence the smith sprinkles sand on the faces to be welded, and the sand (silica) combines with the oxide to form a silicate of iron which is more fluid and has a lower melting point than the oxide, so that it is more readily driven out and permits welding to go on at lower temperatures. This facilitates the smith's work and reduces the chance of oxide being trapped between the surfaces, thereby making the weld unsound.

Thus, the oldest method of iron welding depends for its success upon the presence of a flux. Today other things than sand may be used, but it is sufficient to point out that a flux is a recognized auxiliary in the oldest welding process.

Fluxes in Steel Manufacture

In modern methods of steel manufacture fluxes play an essential part. Roughly it may be said that the steel maker starts with pig-iron, etc., as his raw material, that he treats this crude iron by a fusion process, and while it is melted acts upon it with reagents which have the effect of removing certain constituents and adding others, so that the original crude iron of a certain composition is converted into a steel of a different composition.

Some of the reagents used are of the nature of fluxes. A very simple example occurs in the basic process of making mild steel. The special object of the basic process is the removal of phosphorus from the iron, and the fluxing material used is lime, generally in the lining of the furnace. The phosphorus is oxidized and the resulting phosphoric acid combines with the lime to form (with other things) a fusible slag.

In other processes of steel manufacture fluxes of known composition are allowed to act upon the metal for certain times at certain temperatures, and sometimes two or more different slags are used and removed in succession to bring about the desired changes in the composition of the steel.

The steel maker would be lost if he were deprived of the use of the fluxes and slags as reagents, or the vehicles of reagents, in the chemical processes conducted at high temperatures which change the raw material into the finished product of desired composition.

Fluxes and Their Functions in Arc Welding

In welding ferrous metals by the Metallic Arc process the adjacent edges of the pieces which are to be joined are fused by the heat of an electric arc of which they jointly form one pole, and metal is added by projection from the highly-heated end of the other pole of the arc, generally distinguished as the "electrode." This electrode is a wire or rod of ferrous metal. The junction is therefore made up of metal from three sources, two of them the pieces to be joined, the third the electrode. The pieces to be joined may be called the "work."

Both the work and the electrode are raised to a temperature at which oxidation is rapid in the presence of air. The electrode is hotter than the work, and if bare will be oxidized rapidly for

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*Paper read before the American Welding Society, New York, Nov. 13, 1923.

†Managing Director, Alloy Welding Processes, Limited, London.

some inches above its point. The surfaces of the work and of the metal already fused also oxidize. The oxide is a danger to the soundness of the weld, as it may mix with the fused metal and fail to separate before the metal solidifies, forming an inclusion.

Covering the electrode with some material which shields it from the air until it is on the verge of the arc prevents much of this oxidation and saves electrode metal.

But a flux covering does more than this to prevent oxide inclusions. Following the smith's use of sand, it may have such a composition that it fuses and combines with iron oxide to form a light fluid slag, which floats on the molten metal and does not get entangled with it. This fluid slag also protects the hot work and weld metal from the air, and by combining with any oxide present, cleans the work surface and promotes the union of the metal projected from the electrode. It acts in at least three ways:—

1. In its solid form on the electrode it protects the electrode surface.
2. In its fused state it protects the work and weld surface.
3. It picks up whatever oxide is formed and makes with it a light mobile slag.

It may act in yet another way to the same end. The flux covering may be volatilized wholly or in part by the heat of the arc, and form a vapour sheath or jacket around the arc, preventing access of air to the iron passing through the arc.

That a suitable covering does provide such a jacket external to the arc proper has been proved by experiments with alternating current welding, when it is possible to view the arc at different current phases.

So the first important function of a flux covering is to reduce the liability to oxide inclusions in the weld metal, partly by reducing oxidation, partly by confining oxide to the surface, and partly by cleaning the surface of the work in advance of the arrival of the projected electrode metal.

It is important that a weld shall be homogeneous in respect to chemical composition and mechanical properties with the material of the work. For if it is not homogeneous in these respects, the weld will resemble in greater or lesser degree a soldered or brazed joint consisting of a zone of material different from the pieces which it unites. It is therefore desirable that the weld metal derived in part from the electrode shall be similar to the work metal.

Experience shows that this desirable similiarity cannot be secured by using as the electrode metal of the same composition as the work metal. In passing across the arc the composition is altered. Carbon and silicon, for example, are removed, and as a general rule the metal deposited from an electrode of any ferrous metal is more nearly pure iron. This may be satisfactory for welds in wrought iron or low carbon mild steel, but is not so for, say, cast-iron, manganese steel, or any alloy steel in which it is important that either the mechanical strength or the chemical properties of the weld metal shall be substantially equal to those of the work metal. An example is stainless steel; a weld which will rust is unsatisfactory for uniting two pieces of such steel.

It therefore appears that if the weld is to match the work the necessary qualities must be imparted by reactions with the flux material. This is the same kind of problem as the steel maker has solved by the use of fluxes or slags, and it is found by experience that it can be solved by the proper composition of the flux covering of the electrode.

So another function of the flux covering is to provide a flux reagent to impart to the weld the desired composition.

Another function operates in welding with alternating currents if the covering gives off a vapour which remains gaseous at lower temperatures than iron vapour and has some conductivity. A sheath of such vapour maintains a conducting path through which current passes while the voltage is too low to maintain an iron arc. It is certainly the case that with such a covering alternate current welding is much easier and less subject to the breaking of the arc than with a bare electrode.

Electrodes for Arc Welding

These can be classified as:—

(*a*) *Bare rods of any ferrous metal.* These hardly need description. Experience shows that there is very little difference in the composition of the deposited metal traceable to the composition of the electrode. Oxidation has a maximum effect, both in respect to the iron and any constituent which is easily oxidised at high temperatures. The only flux produced is oxide of iron, which has no cleaning effect on the surfaces and does not readily separate from the fused metal. Nickel-plating bare electrodes improves them to some extent by protecting the electrode material prior to fusion.

(*b*) *Dipped or light-covered electrodes.* These electrodes are dipped in some mixture which on drying, leaves a thin skin of the solids in the mixture. This thin coating affords some protection against oxidation of the electrode surface, and may be of such composition as to provide some fluxing action.

But a coating of this character is insufficient to provide the quantity of flux required for some of the reactions above indicated.

It is necessarily fragile and easily removed by handling. But such dipped electrodes are an improvement on bare electrodes and give sufficiently good results for some jobs.

(*c*) *Flux-covered electrodes.*. These electrodes are coated with a material of substantial thickness and solidity calculated to provide protection to the electrod and to fulfil som or all of the other functions above described.

The flux-covered electrodes made by A.W.P. Ltd., have in general a spiral winding of asbestos yarn as the basis of the covering. Asbestos is a valuable flux in itself, as it fuses and combines with iron oxide into a compound silicate which is very light and mobile, is easily removed after solidification, leaving a clean surface—an important advantage for work which requires more than one run of welding.

Asbestos yarn also makes an excellent vehicle and support for the other constituents of the covering, and with a suitable binder makes a tough-surfaced sheath to the metal core. These electrodes therefore travel and handle without loss and damage.

The general result of much experience is that for welding iron and steels it is useless to adapt the composition of the metal electrode to that of the work. The only way to be sure of getting metal of any desired composition is to adapt the composition of the covering.

Consequently, the practice of this firm is to use for the metal of the electrode a standard mild steel, and to put upon this standard core a covering which will, by its action as flux, impart to the weld metal those ingredients which are necessary to make it match the work material. For example, when welding cast-iron the coating carries carbon in such a form and quantity as to combine with the metal in the required manner, with the result that a microscopic examination of a section across a weld shows a structure which is that of a typical cast-iron. Similarly with alloy steels, the desired composition is produced by flux reaction with the deposited metal.

This practice is convenient and economical.

It is easier to keep stocks of the flux materials, making up the mixtures as required for various classes of electrodes, than to stock a variety of rod and wire of different compositions, and easier to deliver quickly to orders for special purposes.

Also, as metals of special composition will not usually give the results desired, the comparison is not merely between a more or less economical way of meeting requirements, but between one which is efficient and economical and one which is neither.

Why certain constituents are lost from the metal and retained in the flux is rather conjectural. Probably it is because the covering material does not pass through the arc but goes across in a zone or jacket which is at a lower temperature.

This fact is corroborated by the following extract from U. S.

Patent No. 358,191, granted to Mr. Jack Churchward of New York:—

"When welding, due to the intense heat of the arc, the ingredients of the electrodes as they passed therethrough were partially oxidised and volatilised. Hence it became necessary to employ electrode alloys having an excess of those ingredients most liable to be oxidised or volatilised in the arc. The estimation of the exact excess of the oxidisable or volatile ingredients to be employed in the electrode alloy for exactly compensating for the loss in the arc was a difficult matter, and it was still more difficult to manufacture accurately an electrode having such an estimated composition, predetermined upon. The above-mentioned objects may be attained and the former difficulties largely obviated by employing an electrode provided with a uniform compensative outer coating of ingredients adapted to enter the weld."

It should be said that the steel makers' practice and results are by no means directly applicable to the composition of arc-welding fluxes.

The conditions under which the reactions occur are very different.

(*Continued on page 46*)

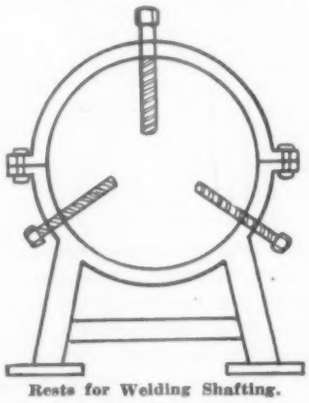
NEW WELDING SHOP IN NEW ORLEANS

"Robertson's Welding Service" is the name of a new welding shop that serves the second United States port, New Orleans, La. This shop specializes in work from other shops and the larger manufacturing plants. It is located at 925 Poeyfarre Street and

The Robertson Welding Shop.

operated by W. M. Robertson, who was president and manager of Deaton & Robertson, Inc., since its organization in July, 1919.

The new plant was built as a thoroughly modern and up-to-date plant, the building being of the "Daylight" type, furnished by the Truston Steel Co., of Youngstown, Ohio. This building, as shown in the photograph, has glass walls 11 ft. 6 in. high. The shop is 24x70 ft. The idea of the glass was to furnish all light possible, thereby minimizing the great contrast between the welding and the general surroundings. This has proven far more effective than was expected.



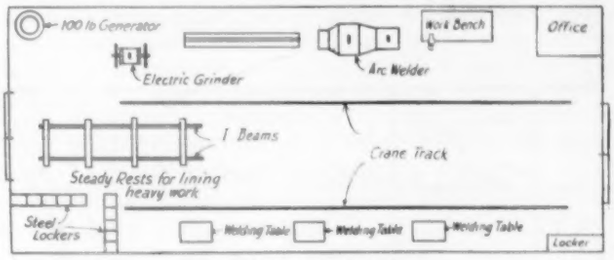
Rests for Welding Shafting.

Since the opening February 15, 1923, there has been continuous operation of electric and gas welding with not a single case of workmen having their eyes burned from the flashes, which heretofore has always been a source of annoyance. The floor is of dirt, so there is no danger from fire or flying concrete. This also allows preheating in any part of the shop. The various welding operations keep it dry and warm, in fact, so much so that it is often necessary to sprinkle. The building is well ventilated, however, to take care of the heat. The building being of glass and steel, great care was taken to see that all lockers and cupboards were also of steel construction.

The acetylene is furnished by a 100-pound generator and piped throughout the shop, with stations so located on the wall that any part of the shop can be reached by two 25-ft. hose, so that in case of double welding the hose will always reach.

Sketch No. 1 shows a traveling crane that takes care of all heavy handling. This crane is mounted on flanged wheels and runs on track laid flush with the floor, it is used for truck loading as well as handling heavy parts for welding.

The floor plan, as shown in Sketch No. 2, will give a good



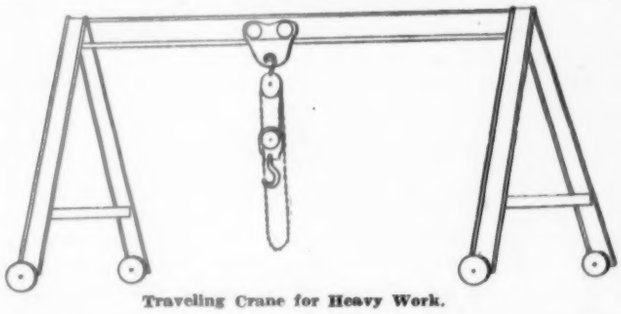
Layout of Shop Interior.

idea of the layout of the shop. Note that the front and rear doors are double, which permits trucks of any size to pass through the entire building, and that there are no office walls, but only a railing to separate the office from the shop. This enables the supervision of workmen from the office at all times, with the least possible effort. The office is equipped with desk, typewriter desk, filing cases and drawing board.

Sketch No. 3 shows rests provided for welding shafting, especially crank shafts of large diameter, as the proprietor has found that they are much preferred to V blocks. In most cases the shafts have to be offset to take care of the contraction and make a straight job of welding. Therefore the rests are readily adjusted to any position for that purpose, similar to the steady rests on engine lathes, except that there are four of them.

The welding tables, as shown on floor plans, have cast iron tops, with 2x2 in. angle iron frames, the tops being faced.

The most novel machine in the shop is the portable electric welder. This machine was put up in the shop and consists of a Fordson Tractor, fitted for street driving, having disk wheels and rubber tires. A suitable bracket was mounted on the rear housing



Traveling Crane for Heavy Work.

for the generator and the pulley in line with the original tractor pulley. The switchboard is located on the left side, supported by brackets on the base of the engine. The reactor is placed on the right side. The regular tractors not being equipped with governors, it was necessary to equip it with a good governor, which can be furnished by most any Ford dealer. The generator is arranged so that it can be slid back in order to tighten the belt. There is one very convenient feature not shown in the photograph and that is the reel for the lead wire. This was applied after the photograph was made. The reel is placed in the wheel and the wire is rolled up in the wheel for road driving. This machine is small and will go where a truck cannot and is a very convenient one man machine, taking care of steamship and factory work, as well as locomotive repairs.

PROPER HANDLING OF CYLINDERS*

Necessity for Keeping Close Watch on Cylinders and Returning Them Promptly, When Empty, to the Gas Manufacturer

By H. Llewellyn†

IN many plants and operations the purchasing department is burdened with the troublesome and vexatious problem of keeping track of empty wire reels, oil drumbs and other containers, which usually are the property of the shipper and are only loaned to the customer.

The capital invested in such equipment runs into very large figures. This makes it imperative that the containers be returned to the original owner without delay and in good condition, which very reasonable request is customarily made by the shipper.

Adventages of Prompt Return

By promptly returning such containers, the plant, storeroom or yard presents a clean and orderly appearance instead of being an eyesore. When executives and officers visit the mills they quickly note an accumulation of this kind; and when the plant is free from such material it is also noted and commended.

An accumulation of empty barrels, reels, etc., is a decidedly dangerous fire risk, and insurance inspectors are prompt in pointedly having this condition rectified. It is negligent and dangerous to permit such a condition, and it should be the duty of a purchasing agent, as an executive and responsible officer of his organization, to see that no unsightly pile of containers is permitted to accumulate.

But how may this problem best be handled? By keeping within the purchasing department, a check or record on each container shipped. Keeping such a record entails but little work, and its practicability, usefulness and value have been demonstrated beyond question in our organization.

A record, such as shown in the accompanying illustration, enables one to see at a glance what containers are still outstanding. We prefer the sheet form to cards, for cards are often lost or misfiled and thus become dead records. The principal value of any record in the purchasing department is its visibility, and we believe we have this in the form shown.

Summarizing the form, we strive to maintain clear records which instantly show what barrels or containers are still in the mill, how long they have been there, cost, shipper's name and location. Once every month this record is gone over with the mill, and all containers outstanding for thirty days are checked up. We also co-operate with the shippers by exchanging a list each month and any errors in numbers or marks are promptly checked.

	INVOICE DATE 1923		SHIPPER	AMOUNT OF INVOICE	BARREL NUMBER	DATE RETURNED	SHIP REF. NUMBER	PRICE OF BARREL	OUR ORDER NUMBER
	June	9	Atlantic Refining Co.	87 40	13784			Memo Chg.	6484
	"	"	" " "		9816	6-20-23	7391	" "	"
	"	"	" " "		5756			" "	"
	"	"	" " "		34849			" "	"
	"	11	Waverly Oil Works Co.	46 17	14667	6-27-23	7518	15 00	6519
	"	"	" " " "		3974	6-30-23	7586	15 00	"
	"	17	General Chemical Co.	164 26	576			8 00	6647
	"	"	" " "		483			10 00	"
	"	21	Vacuum Oil Co.	87 09	27294	7-5-23	7619	6 00	6728
	"	26	" " "		18339			6 00	"

Simple and Effective Method of Keeping Track of Cylinders.

Cylinders for Compressed Gases

One of the romances of modern industry is the development and use of compressed gases. Every purchase of compressed gases, such as oxygen and acetylene for oxy-acetylene welding and cuting, has at one time or another been confronted with the empty cylinder problem.

As purchasing agents, we have been exhorted to return our empty cylinders promptly, to enable the manufacturer to give us better service. We have been asked to keep cylinder records and to use cylinders in the order in which they are delivered. In some cases we have even been asked to permit the gas manufacturers to send men into our plants in an endeavor to find their own cylinders—their own property—on which our records and their records had failed to agree.

Possibly many of us who are exerting the greater part of our time, experience and effort to secure the greatest value for each dollar we spend, are, upon first consideration, apt to take the stand that our compressed gases, like most of the commodities we buy, shall be packed and shipped by the manufacturer in whatever way he sees fit, this problem is one for the manufacturer alone to solve. I would not assert that this attitude is in any way general, but in a few cases I feel sure purchasers of compressed oxygen have felt that when their wants have been temporarily satisfied, there is no need for further action until a requisition comes through from the storekeeper for an additional supply of oxygen or acetylene.

*From a paper read before the Purchasing Agents' Association of Pittsburgh, June 19, 1923.

†General Purchasing Agent, Pittsburgh Steel Products Co., Pittsburgh.

At times, when our orders for oxygen have been placed, we have been asked about the return of empty cylinders. Or possibly a salesman has called and told us that we could help him and his company by returning empty cylinders which they have reason to believe are in our possession. It might even be intimated that our order could be shipped a little more speedily if the empties were returned. Possibly the same though is expressed in a little different way, and we are given to understand that if we will work with the supplier his ability to give the best of service to all the users of his gas will be increased.

In any case, it is a plea for our co-operation and there is not the slightest doubt that in the long run the actual user of the product reaps the greatest profit from this co-operation.

Many of us realize that a high degree of co-operation between ourselves and the oxygen manufacturer will result in better service to ourselves. It will help the manufacturer to give us what we are anxious to secure, what it is necessary that we have if our use of the oxy-acetylene process is to reach its maximum efficiency in our plants—and that is a dependable supply of oxygen.

Every manufacturer of commercial gases is anxious to give us the best service he is able to give and to maintain the cost of his products at a price consistent with the standards of service and quality of product he has set for himself, and which, in most cases, are the principal stock in trade. By aiding him in making the most of his investment in cylinders, therefore, we can assist in assuring ourselves of the things we desire most from the organization supplying us with the gases we use, while at the same time aiding the manufacturer in efficiently conducting his business.

It is generally conceded that, in one way or another, the consumer defrays the cost of transportation of the commodities he buys from their place of manufacture to the point where they are used.

Reducing the Transportation Cost

To increase the amount of oxygen carried per dollar spent for freight, the practice has been generally established, particularly in the oxygen field, to compress this gas to 2,000 lbs. pressure per square inch in the cylinder. This very high pressure makes necessary the use of a high quality container, equipped with a valve designed to prevent loss and wastage, both while the valve is closed and when it is open and the gas being used. These cylinders must also be of sufficiently sturdy construction to stand the rough usage to which they are necessarily subjected in shipment, so that the repair and maintenance costs will be kept at a minimum.

To keep oxygen cylinders in the proper condition for use, it is necessary that a very thorough system of testing and inspection be maintained by the owners. The cylinders must at all times comply with rules established by the Interstate Commerce Commission and with various other state, municipal and local regulations governing the type of container which may be used in the transportation of high pressure gases and the inspection to which these cylinders must be submitted to assure that they comply with the established rules.

If it were necessary for us, as users of compressed oxygen, to carry this investment in cylinders and to maintain the organization and equipment for their proper testing, the burden would probably be so great that we would be obliged to forego the use of the highly efficient oxy-acetylene welding and cutting process. So the gas people have undertaken to carry this investment in cylinder equipment and to maintain the necessary organizations to make certain that the cylinders used will always be in proper and safe condition for service.

Oxygen cylinders are specially made. They are seamless drawn steel-high-pressure cylinders, equipped with a special high-pressure valve. To protect the valve, the cylinders are fitted with a cap which screws to the body of the cylinder over the valve. Hundreds of thousands of these cylinders are in service throughout the United States and the investment in this equipment runs, literally into millions of dollars.

It is readily apparent that this enormous investment must have some bearing, even if only indirect, on the price each of us has to pay for the oxygen he uses. The amount of money tied up in equipment of this kind is reflected, to some degree, in the gross amount it is necessary for the manufacturer to obtain for the gas he sells; and we who buy the gas, naturally, are the ones who will finally feel the effect of any great increase necessary in the capital required for cylinders.

Universal Benefit of Co-operation

In discussing the investment in cylinders, I do not have in mind any single manufacturer. Regardless of the immediate source of one's oxygen supply, the industry as a whole is adversely affected by any action which tends to make necessary a further investment in cylinders by any one manufacturer, and the industry as a whole is greatly helped by any action on our part, as purchasers and users of oxygen, which will have the effect of releasing, for the service of all purchasing agents, oxygen cylinders lying idle around our plants.

The matter of service, too, is an important factor in this same connection. Everything we can do to release, into prompt and active service, cylinders not serving a useful end in our plants, will place the oxygen manufacturer in a better position to give us our supply of oxygen when we want it and as we want it. Those of us who have been situated so that it was imperative to have an immediate supply of oxygen in an emergency, can readily appreciate what it may mean to us for our supplier of oxygen to have on hand the reserve of cylinders he constantly strives to maintain.

For the oxygen manufacturer to give the best possible service with the minimum number of cylinders, and consequently with a minimum investment in cylinder equipment, it is necessary for him to have the co-operation of all purchasing agents, who are users of his product. His cylinders must be returned to him promptly.

The prompt return of all containers is necessary, first, to the manufacturer because it helps him to give us better service; and, second, to us because it aids in maintaining prices on the most favorable basis and assures us of a supply when and as we need it.

There are several ways in which we can co-operate with the manufacturer to our own advantage. The first, and probably the most important, is to return all containers to the plant from which they are shipped just as soon as they are emptied. Whether you send cylinders back singly or in carloads will depend upon the quantity of gas you are using. If it will delay the shipment for several days to get a carload or a truckload together, ship back a smaller quantity of empties. Do not wait for the time when you have a quantity of empty cylinders on hand sufficiently large to warrant carload or truckload movements. Get the empties back as soon as you have them available and it will react to your advantage and to mine.

When cylinders are held out of service the effect is not alone on the user of oxygen who actually has the empty cylinders in his possession, but is on all the oxygen users in the district. By holding empty cylinders which should be returned, the natural effect is to cut down the reserve supply of cylinders available, and this reacts to the disadvantage of every oxygen user.

Handicaps From Over-Buying

Another point to be considered is over-purchase—the carrying on hand of an excessively large reserve supply. Each manufacturer endeavors to maintain at all times a reserve supply of full containers at distributing stations, subject to the call of purchasing agents, so that no emergency can present itself that will find him unable to supply a demand for an extraordinarily large quantity of his product.

As purchasers, we should depend upon this reserve, rather than attempt to build up a reserve of our own. An excess of full cylinders in our own storeroom is not available to other users who may require an emergency shipment. The other fellow's stock would do us no good if we needed an unusually large quantity of oxygen on short notice. But in the hands of the oxygen manufacturer, the reserve supply is available to those who need it. It works as a sort of Federal Reserve System for the oxygen-consuming industry.

Help!

Last month we announced a new Rego Welding torch of Gooseneck construction. It evidently pleased the welders—we are swamped with orders. **Please,** Mr. Welder, have patience. We've added new machinery to speed up production and your order will go out soon.

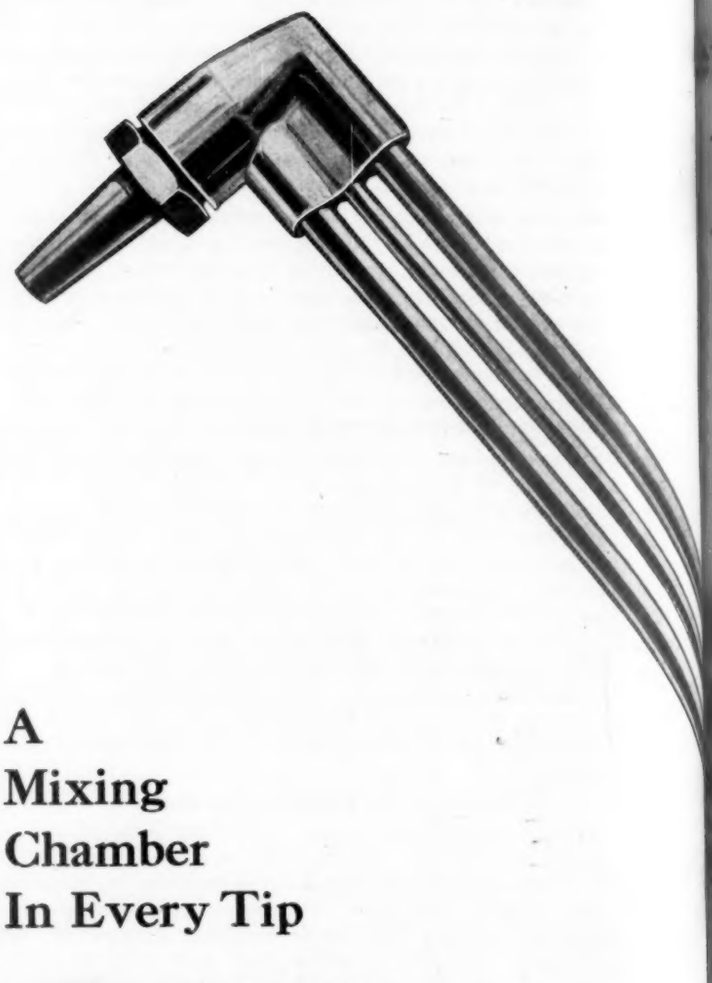
More Good News

The Rego C cutting torch has always been a leader because of its speed and economy of cutting. It was hard to conceive how it could be improved. But Rego engineers are **never** satisfied and **have** developed the new Rego K Kutter. This puts Rego so **far** ahead of all other cutting torches that there is **no** comparison.

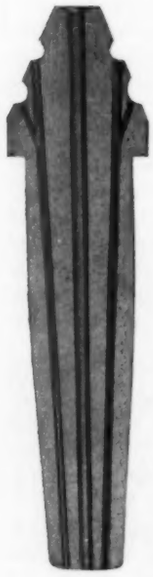
Have you ever seen a cutting torch that embodies **all** of the following features?

1. **Tips** of one **solid** piece of real honest to goodness heat resisting **nickel** copper.
2. Tips containing their **own** mixing chamber complete in one piece.—No leaky and easily burnt out **brass** internals or separate pieces.
3. Tubing of one **continuous** seamless piece from head to butt—no threaded or soldered joints in its entire length.
4. A high power valve seat spring that keeps the valve **tight** and an 8 in. lever that opens it with a slight touch.
5. A handle of generous size that feels right in a he-man's hand.
6. The preheating holes tapered toward the oxygen jet making a fast and narrow cut.
7. A torch that will blow holes through metal without a flash or stop.

The Bastian-Blessing Co.
246 E. Ontario St., Chicago, Ill.



A Mixing Chamber In Every Tip

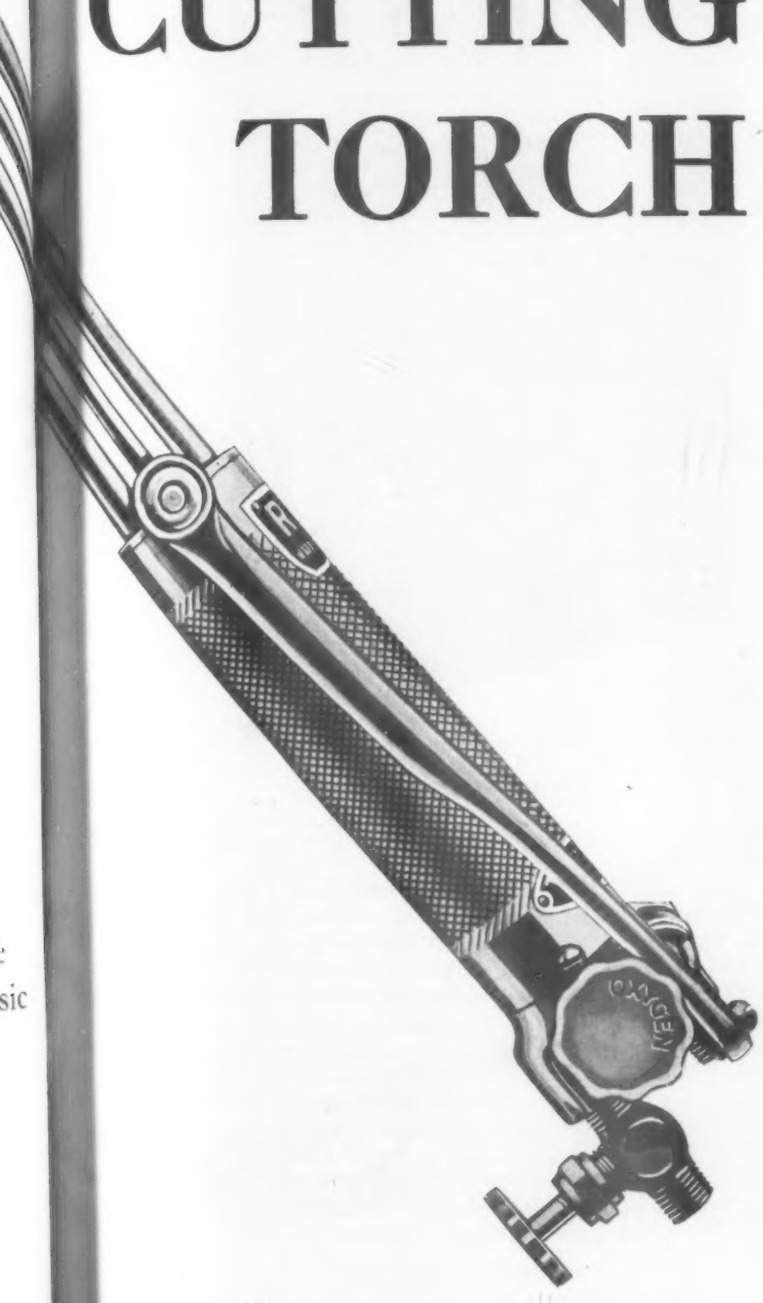


A construction that insures *perfect* mixture and *full* heat value —covered by *basic* patents. Preheating holes as a *part* of the tip are also a patented construction. It will pay you to be sure that the equipment you use is manfactuured under these basic patents.

REGO

Model K

CUTTING TORCH



REGO REGO REGO REGO

REGO K Kutting Torch

A torch designed for all general cutting work, and used extensively in railroad shops, ship yards, scrap yards, steel mills and foundries. The small tip nut makes it especially handy for close work, such as cutting risers from castings, and removing rivet heads.

Specifications

Rego Model K Kutting torch is 20 inches long. Regularly furnished with 90° head, but can be had with 75°, 35° or straight head. Straight hose connections.

Special Tips

K tips are for use with oxygen and acetylene. KH are tips for oxy-hydrogen and KB are for oxygen and Butane, thermoline, pyrogen or other low heat value gases. Rivet cutting tips (RK) and one preheat hole sheet metal tips (KS) may be had if specified.

Prices

K torch for oxy-acetylene—5 tips	$55.00
KH torch for oxy-hydrogen—5 tips	55.00
KB torch for oxy-Butane, etc.—5 tips	60.00
K torch without tips	45.00
K or KH tips for acetylene or hydrogen, each	2.50
KB tips for Butane, etc., each	4.00
RK Rivet cutting tips, each	3.00
KS Sheet metal tips, each	3.00

Prices on complete outfit on application.

The Bastian-Blessing Co.
246 E. Ontario St., Chicago, Ill.

REGO REGO REGO REGO

Experience will dictate the quantity of gas necessary to carry on hand. Only when the quantity established as a minimum reserve is reached should additional full cylinders be ordered. And when the order is placed, we should be sure that every emtpy cylinder in our plant is ready to be returned.

The highest degree of co-operation between the consumer and the manufacturer will be reached when there is a close co-operation between the various departments within the user's organization. This is particularly true of close harmony between the purchasing department, stores department and the various operating sections. A check of the various departments in a plant may uncover empty containers which had not been returned to the storekeeper when full cylinders were requisitioned.

Cases of this kind point to the necessity of installing some kind of a cylinder accounting system within an organization using a considerable quantity of material. The manufacturers keep a careful check on their containers by individual numbers, in the same way that railroads account for their freight cars. Empty containers accumulating in a plant show up on the manufacturer's records in the same way that idle cars show up in the car movement records of the railroad.

When a consumer keeps a record of the number of the full cylinders he receives, charges the full cylinders out by number to the various jobs, and insists that these particular cylinders be returned, empty, when additional full cylinders are requisitioned, he can always be sure that empties are not accumulating in inaccessible parts of the plant. In addition, he can be certain that he is using the cylinders in the order in which they are received. We handle this simply by attaching a purchase requisition to the bill of lading covering the return of a similar quantity of empties.

If the full cylinders received in the last shipment are always the first to be used, the result will be that the same few cylinders will always remain in stock. Sometimes when these are taken out to be used it will be found that the rubber packing in the cylinder has hardened from long standing, and the oxygen originally in the cylinder has escaped, which is our loss.

Avoiding Damage by Prompt Return

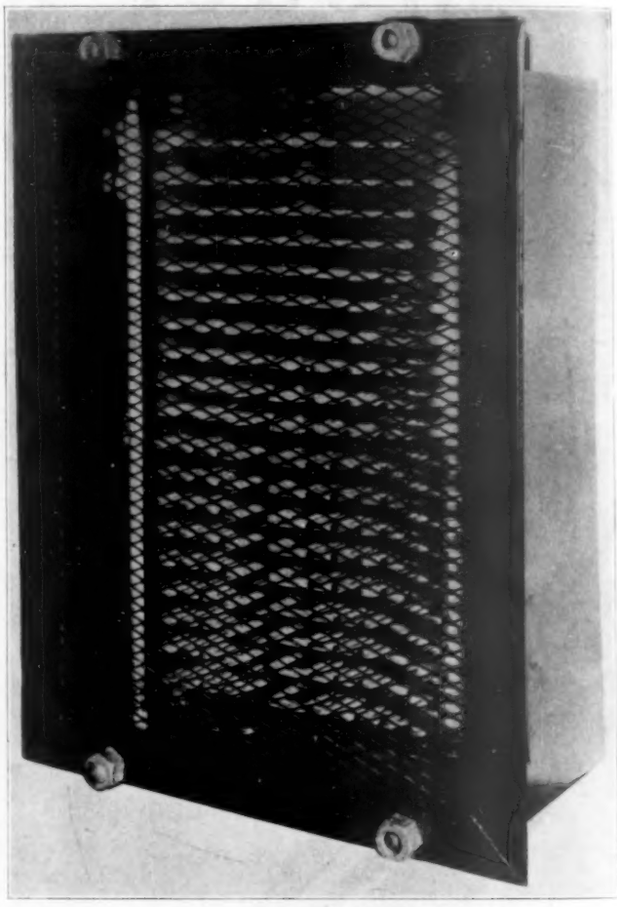
A record of the movement of containers around a plant and their prompt return when empty will, in a large measure, overcome the other point which handicaps the manufacturer in his efforts to give us the best possible service—damaged cylinders. Empty cylinders standing around the plant collect dirt and grease which must be carefully removed before the cylinder is again used. The paint wears off the cylinder and rusting results. The valves, often unprotected by cans are damaged or lost. In many cases, the cylinders are crushed or dented by contact with heavy castings or through rough usage. Even a small dent in a high-pressure cylinder is sufficient to make it necessary to scrap the cylinder.

When a record of cylinders by number is carefully kept, the user of oxygen may always be sure of a stock, sure that the cylinders are moving through the different departments in his organization in the proper manner, and sure that the empty cylinders in the plant are being promptly returned to the point from which they were shipped.

All the effort we expend in co-operating with the manufacurers of compressed oxygen in securing the prompt return, as soon as empty, of their cylinder equipment, will return dividends to us in the form of better service. The oxygen manufacturers are anxious to give us our supplies when we want them and as we want them. My own experience reveals that in many cases they have gone to great lengths in the way of extraordinary service to help us and to please us. They are carrying a heavy investment in equipment which they loan to us without a charge for its use. These things would make it fair and proper that they have the hearty co-operation of all purchasing agents, even if we ourselves had nothing to gain.—*The Purchasing Agent.*

G-E CURRENT REDUCING RESISTOR

The new CR-9645-10 current reducing resistor recently placed on the market by the General Electric Company to meet the demand for welding equipment by means of which light gauge sheet metal can be welded consists of standard cast iron resistance grids to be connected in series with the arc. This device is for use in conjunction with the General Electric standard WD type welding generator. The cable connection from the generator is brought to one end of the resistor and the other cable which runs from the resistor to the arc is connected to the resistor by means of one of the terminals placed along the grids, allowing the adjustment of the amount of resistance in the arc circuit. In addition to the regulation which may be obtained by tapping in at these various points on the resistor, intermediate adjustment can be obtained by changing the position of the dial switch on the generator control panel. This adjustment can be obtained between each tapping point on the resistor. By this method, the operator may obtain any welding current from approximately 25 to 75 amperes.



G-E Current Reducing Resistor.

Mica washers of large diameter insulate each grid of the unit from those adjoining, increasing the creepage distances and reducing the possibility of short circuits from the accumulation of metallic dust. Good contact between grids is insured by large, well finished surfaces and spring lock washers. Each standard section is furnished with a terminal at each end. Additional terminals may easily be slipped in by loosening the clamping nuts. All grids are supported by three tie rods and those of small cross section are reinforced to minimize breakage from vibration. The pressed steel end frames are duplicates and of uniform size for all sections. The sections may be bolted together and stacked, affording economy in floor space. The grids are insulated from the tie rods by mica tubes and the tie rods, from the end frames, by fibre, giving double insulation to ground.

A MOBILE CRANE, TRUCK AND TRACTOR

The "Duat," said to be the smallest industrial truck and tractor ever built, has just been announced by the Clark Tructractor

Company, Buchanan, Michigan, manufacturers of gasoline industrial trucks and tractors.

The "Duat" Tructractor is a compact, 3-wheeled gasoline powered mobile crane, truck and tractor. It pivots on one wheel and has a turning radius of but 52 inches. It turns around in a box car. It is an inexpensive general utility haulage unit.

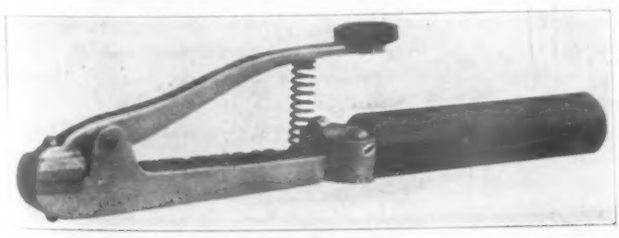
The "Duat" Tructractor tows from seven to ten tons or from one to twenty trailers, depending on the condition of the factory floor or yard. Through an ingenious device, a one-ton crane is attached to the "Duat" without the use of tools, in less than five minutes, converting the "Duat" into a mobile crane. The crane attachment will lift and carry loads up to 2,000 lbs. A brake device permits the load to be carried at any height up to 56 inches; load may be lowered at will. The machine has been designed for the loading and unloading of box cars, the lifting and towing of loads through narrow factory aisles, and for interplant haulage.

Tructractor With Crane Attached.

It is of 3-wheeled construction. Ample traction is provided by 16-inch wheels equipped with 3½-inch solid rubber tires. The "Duat" has a wheelbase of 40 inches with a tread of 33 inches. A brake beneath the driver's seat which automatically stops the machine when the driver dismounts is a safety factor. The "Duat" answers many needs for the craning and transporting of materials in and about industrial plants, railroad stations and terminal, machine shops, clay plants, mills, warehouses, docks and storage yards.

NEW GIBB ELECTRODE HOLDER

The Gibb Instrument Company, of Bay City, Michigan, are putting on the market a new type of electrode holder for electric arc welding. One of the principal features of this holder is that the cable connection is located on the outside



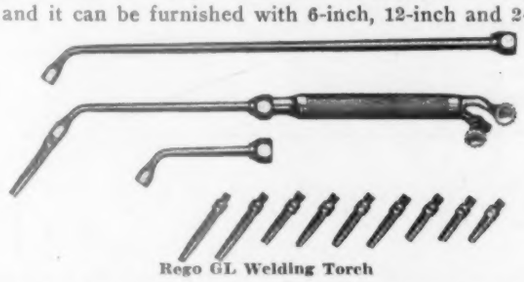
New Gibb Electrode Holder.

of the fibre handle. This connection is of light material which has high conductivity, consequently, the makers point out that there is less danger of the holder becoming overheated.

Another feature is the removable copper jaws making necessary only a very minor replacement when the consumption of the electrode causes an arc to be drawn on the holder or when slipping of the wire causes arcing between the jaws. The fibre handle is air-cooled and is equipped with an interchangeable spring and fibre thumb piece.

TWO NEW REGO MODELS

Two new series of torches have recently been perfected by the Bastian-Blessing Co., Chicago. One of these is a series of Gooseneck Welding Torches. The model GL Gooseneck Torch illustrated here is a large torch for heavy preheated castings; engine cylinders and frames, large pipe welds and the general run of heavy work. The torch itself is 13 inches long, and it can be furnished with 6-inch, 12-inch and 24-inch



Rego GL Welding Torch

extensions. Special features of this new line of torches are the nickel copper tips, the wide range of interchangeability of tips and special taper drilling. Gooseneck Torches are made in medium and small sizes. Officials of the company state

Rego K Cutting Torch

that they have no intention of discontinuing their line of two tube angle torches, but will manufacture both styles.

The smaller illustration is of the new Rego K Cutting Torch, designed for all general cutting work. The torch is 20 inches long and can be furnished with 35, 75 or 90 degree heads. Straight heads can be supplied also if desired. The hose connections on this torch are straight. Special features of the construction are solid angle copper tips with self contained mixing chamber, a high power valve seat spring controlled by an 8-inch lever, preheating holes tapered toward the oxygen jet, and tubing of one continuous seamless piece from head to butt.

ELECTRIC WELDING OF CUTLERY

An invention by H. F. Atkins, of Peterborough and the British Cutlery Research Association, states that it has been proposed to manufacture table knives and other cutlery from three separate parts afterwards being electrically welded into one. The object of the present invention is to enable the three parts, such as the blade, bolster and the tang of a table knife to be welded together at one operation while keeping each weld under separate control. To carry out the invention two transformers are used. The currents from the secondary wiring from both transformers are caused to pass through the central part of the three parts to be welded together, but after this the current from one transformer is passed through one outer part and the current from the other transformer is caused to pass through the other outer parts.

In other words, the central part is connected to one secondary terminal of both transformers while the outer parts are connected to the other secondary terminals, one outer part to each secondary terminal.

It will thus be seen that it is possible if so desired, by connecting both primary circuits, to start the current for each weld at the same time, and by breaking each primary circuit separately to control each weld apart from the other.—*Acetylene and Welding Journal.*

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Why Fools Rush In

DURING an investigation of the explosion hazards of oxygen and lubricating oil, conducted at the Pittsburgh Laboratories of the United States Bureau of Mines under the direction of Dr. Mayo D. Hersey, it was found that attempts to produce an explosion with oxygen at 140 degrees Fahrenheit in contact with various grades of oil resulted in failure. Dr. Hersey points out the hazard of negative results in such experiments, a hazard which is even more pronounced in cases where experiments are not made under laboratory conditions. A workman disobeys some fundamental safety rule in the shop and gets away with it. He gets away with it because *all* the conditions for an accident do not happen to be present at the right time, but he does not know what condition was missing nor how close he came to a serious accident. His conclusion, therefore, is that that particular safety rule is the bunk. When his mistake catches up to him, the newspapers will blame his sudden demise on a perfectly safe piece of apparatus, but the real cause will be a stupid indifference to wise words of caution.

A Plea for Simplified Education

THE greatest need of American education is simplification. Dr. Thomas S. Baker, president of Carnegie Institute of Technology, told the New York City alumni of Carnegie Tech at a dinner and re-union held recently. "College and school executives," he said, "are so enmeshed in a maze of administrative details that they are in danger of building up systems rather than strengthening faculties. Too many courses are being given both in the schools and in the colleges. We are sacrificing thoroughness as we extend our program of work."

In suggesting possible solutions by which engineering schools may advance in the next generation, President Baker, predicted more atention to research of a technical nature, more attention to the solution of business problems, and expansion by the urban colleges of their evening and extension courses as an aid to industry in giving employes training along special lines. He said in part: "We are continually looking for a system of education which will meet the needs of the times. We shall never find one. We are giving too much importance to methods and not enough to substance; too much importance to courses of study and not enough to the individual teacher. College and school executives are so enmeshed in a maze of administrative details that they are in danger of building up systems rather than strengthening faculties. The greatest need of American education is simplification. Too many courses are being given both in the schools and the colleges. We are sacrificing thoroughness as we extend our program of work. The public is expecting of the colleges training in too many kinds of vocations. Even in the technical schools we could well afford to throw overboard some of our specialties and focus our efforts upon teaching more thoroughly the subjects that are essential in the training of an engineer. It is futile to expect to turn out an accomplished engineer in four years of undergraduate work. We can only hope to give him the foundation, and the changing technique of his profession must be learned through practical work.

"Speaking generally, I believe the educational institutions of the country can be of greater practical service to the communities in which they are situated; but in the main, their practical work should be divorced from their general educational work. There is danger in making the undergraduate courses practical. In the end, paradoxical as it may seem, the highest practical good may be achieved by promoting abstract scientific studies."

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PROF. THOMSON AWARDED KELVIN MEDAL

Prof. Elihu Thomson, one of the founders of the General Electric Company, and among the world's most eminent electircal engineers, has been awarded the Lord Kelvin gold medal and will go to England during the coming summer receiving the medal on July 11.

The award was made by British and American engineering socictics acting jointly. It is awarded every three years as a mark of distinction and for excellence in original research work in engineering. Prof. Thomson is the first American to receive this honor.

Prof. Thomson became professor of chemistry and physics in the Central High School in Philadelphia in 1876. Being interested in electricity, he began work in dynamo and electric lighting development while teaching. The result of the work was the establishment of the American Electric Company in New Britain, Conn.

Prof. Thomson has been granted about seven hundred patents in the United States. His inventions in dynamo electric machinery, electric welding, watt-hour meters, lightning arresters and magnetic arc extinguishers are fundamental. He was a pioneer in arc lighting and innumerable electrical devices have been improved through his work.

He has received the honorary degree of Master of Arts from Yale; of Doctor of Philosophy from Tufts, and of Doctor of Science from Harvard, and has been decorated as a Chevalier et Officer of the Legion D'Honneur of France. For his achievements in the electrical field he was awarded the Grand Prize at the Paris Expositions in 1889 and 1900 and the St. Louis Exposition of 1904. He was president of the American Institute of Electrical Engineers in 1889 and the first recipient of the famous Edison Medal. He has been awarded the John Fritz medal of the four national engineering societies, the Hughes medal of the Royal Society of London, the Rumfold medal, the Elliott Cresson gold medal by the Franklin Institute, and twice received the John Scott Legacy medal for electrical inventions.

CHANGES IN SALES ORGANIZATION OF THE LINDE AIR PRODUCTS COMPANY

Mr. Robert W. White, assistant general sales manager, the Linde Air Products Company, manufacturers of oxygen for welding and cutitng of metals, has been appointed general sales manager of the Carbide and Carbon Chemicals Corporation. Mr. L. M. Zimmer, western sales manager of the former company, has been appointed assistant general sales manager to succeed Mr. White. These changes were announced effective as of January 1st. Both Mr. White and Mr. Zimmer will continue to make their headquarters at 30 East 42nd Street, New York City.

Other changes made at the beginning of the new year in the executive personnel of the Linde sales organization include the appointment of Mr. E. E. Radcliffe, assistant sales manager, Eastern Division; Mr. Herman Ullmer, assistant sales manager, Western Division; and Mr. F. E. Stoppenbach, district sales manager, New York District. Messrs. Radcliffe and Stoppenbach are located in the company's headquarters in New York, and Mr. Ullmer in Chicago.

WESTINGHOUSE PUBLISHES A NEW INSTRUMENT CIRCULAR

The Westinghouse Electric & Manufacturing Company has recently issued a 24-page, two-color, well illustrated booklet, Circular 1664, entitled "Indicating Instruments for Direct and Alternating Current."

The introductory chapter includes a brief and interesting resume of the development of electricity with special reference to the development of alternating current and the earlier alternating-current instruments.

The research that resulted in these new instruments began with analyses of all activities requiring the use of electrical measuring instruments, and all the known principles of operation and construction. In the second chapter is related the story of this research, and there, also, are discussed the principles of operation and construction of the instruments as now manufactured.

The remainder of the book is devoted to the instruments themselves. One chapter is devoted to questions of standardization and sizes, insulation, compactness, readability, sturdiness, accessibility, simplicity, damping, accuracy and calibration. Another chapter offers a description in detail of the parts making the completed instrument. The last chapter is devoted to instrument applications.

BECKET AWARDED PERKIN MEDAL

Frederick M. Becket, chief metallurgist of the Electro Metallurgical Company, and vice-president of the Union Carbide and Carbon Research Laboratories, Inc. (both subsidiaries of the Union Carbide and Carbon Corporation), was awarded the Perkin Medal of the Society of Chemical Industry, on January 11, 1924, for his achievements in the field of applied chemistry.

Mr. Becket has spent a lifetime in working with electric furnace products, principally those ferro-alloys and alloying metals which are indespensable to basic open-hearth steel, and the alloy steels so widely used in automobiles, high grade tools and machinery. While he has been closely associated with the entire ferro-alloy industry, his influence has been especially marked in his discoveries and developments in the reduction of molybdenum and vanadium with silicon metal, the perfection of low-carbon ferro-chromium, chromium metal, and many heat-resisting alloys of iron and chromium, and quite recently the perfection of manufacturing processes and the technique of using the new alloy ferro-zirconium. The latter has developed most attractive qualities for steel making, in that it at once counteracts the bad effects of oxygen, phosphorous and sulphur in steel.

In addition to these many activities, Mr. Becket has been greatly interested in metallurgical problems connected with welding and cutting by the oxy-acetylene flame, and is directing noteworthy investigations along these lines.

WELDING IN MEXICO

W. I. Norden, of Tampico, sent us this photograph which illustrates the interesting variety of work that found its way into the welding shops in Mexico.

Variety of Work in Mexican Welding Shop.

The jobs in the shop include an all-welded speeder frame, a manifold for gas burners, an assortment of well plugging implements and a stove made of 16-in. pipe. The job just completed on the welding table is a crank case in which a large crack has just been welded.

The Wilson Welder & Metals Company, of New York, recently furnished welding equipment consisting of three gasoline engine-driven welding machines and Wilson welding wire to the George S. Curtis Company, who are erecting two oil storage tanks of 80,000-barrel capacity each, for the Sinclair Refining Company at Tremley Point, N. J. These tanks are 117 ft. in diameter, 42 ft. high and the entire bottoms and roofs will be electrically welded. This is a comparatively new type of tank and a large number are now under construction in the mid-west and southwest oil fields.

Hints for the Welder

When you finish an interesting piece of work, can you set down on paper the manner in which you went about the job, how you prepared the work and how the job was done? Have you learned some little stunt every welder ought to know? Contributions to this department are paid for. Write it down any old way – I'll polish it up. Make a rough pencil sketch and our draughtsman will fix it up fine. Line drawings are more practical than photographs. Do it today – the men on the firing line are waiting. L. B. Mackenzie, Editor.

LATHE RAISING BLOCKS

By Edwin Kilburn

Our shop handles work which ranges in size from smaller than a carburetor needle valve to parts from a steam shovel, the variety of our work being so great and our machine tool equipment somewhat limited, it is but natural that at times we find ourselves confronted with jobs of greater size that the capacity of any of our machines and particularly is this true of some lathe jobs.

In order to enable us to handle certain jobs which frequently came to us it became necessary to equip our lathe with raising blocks to enable us to swing pieces of larger diameter than the nominal swing of the lathe. We could have obtained these from the factory, but found that the cost was almost prohibitive and delivery so slow that at the time we were considering the matter we would lose considerable business while waiting. So we decided to build our own raising blocks. The job has been very successful in service, and as welding played an important part in doing the work I am going to describe the methods used, hoping that they may enable others to economically perform similar jobs.

All machinists are familiar with the ordinary engine lathe bed which in sectional outline is similar to Fig. 1. Our problem was was to raise the head and tail stocks and tool post a certain distance from the bed, further than their original position, it also being necessary to preserve the alignment with the bed and with the other parts.

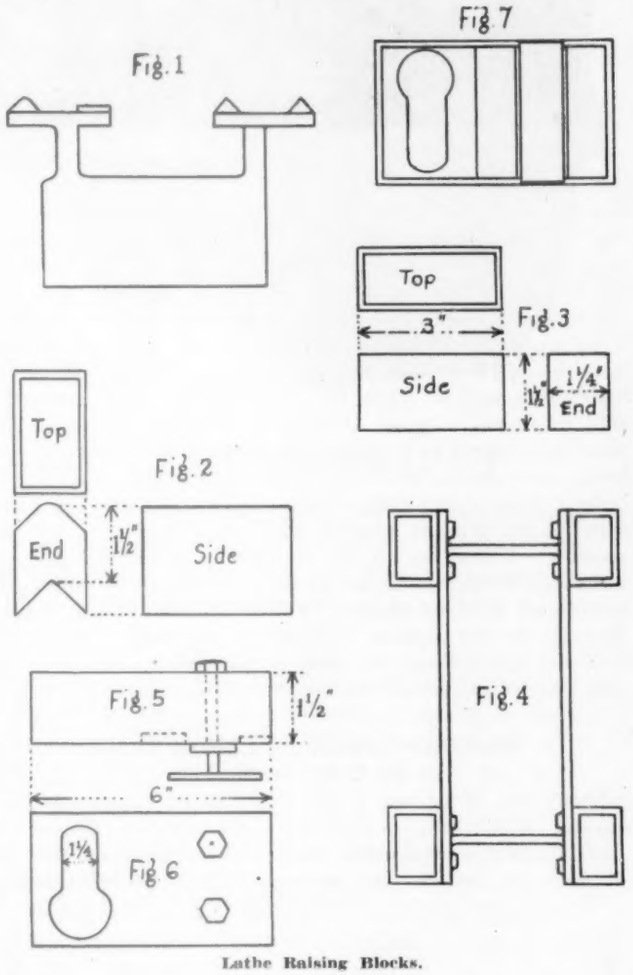
Our problem was complicated by the fact that our shop has no equipment for planing or shaping iron, therefore all the fitting was a hand job. To raise the head and tail stocks, hollow blocks as shown in Figs. 2 and 3 were made, the material used being flat, mild steel 3/16"x1½". Our plan was to raise the lathe center line approximately 1½". As will be seen from the drawings these blocks are approximately 3" long, 1¼" wide and 1½" high; there are four welds in each block, each corner being welded together.

The blocks were finished to the required dimensions and then a frame made of mild steel 3/8"x1" was made as shown in Fig. 4. This also required four welds. The frame was made of the proper dimensions to hold the raising blocks in proper position under the head and tail stocks, the blocks being fastened to the frame with cap screws as shown.

The block for raising the tool post presented quite a problem in itself, since it was necessary not only to raise the tool high enough to be in line with the lathe centers but it also was necessary to locate it outside its regular position in order to gain increased diameter capacity.

Figs. 5, 6 and 7 show how this was accomplished, a rectangular box-like piece being made as shown in the various figures. The material used was ¼" thick, Fig. 5 represents a side view, Fig. 6 a top plan view and Fig. 7 a bottom plan view. The width 4" shown in Fig. 6 corresponds to the width of the compound rest; the height 1½" corresponds to the amount the head and tail stocks are raised. The cross bar shown in Fig. 5 and 7 is finished to the width of the tool post slot in compound rest and the whole block is attached to compound rest by two clamping bolts and clamping plate as shown in Fig. 5. This block is made of 1¼" material for the sides, 4" material for the top and the cross bars shown in dotted outline in Fig. 5 are 1¼" wide. All joints where the different members adjoin were welded and the result is a very stiff, strong construction; it will be noted that the top plate is cut out to admit the tool post.

The attachment has proven very satisfactory in service and practically the only change we would make if we were making another set would be to make the blocks higher, to give greater capacity. Welding enabled us to construct these pieces with much less expense than by any other way, taking into account the somewhat meager tool equipment of our shop.



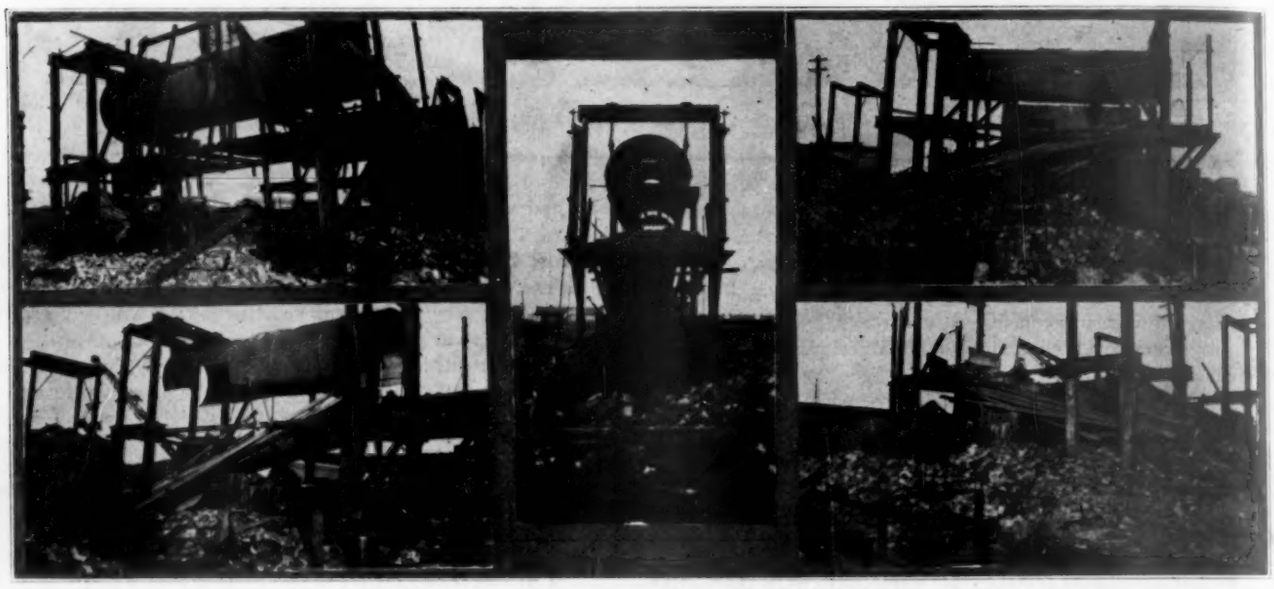
Lathe Raising Blocks.

REDUCING A PUDDLE MILL TO MELTING SCRAP

By P. E. Boltz

Very often the question of procedure in a big cutting job is of considerable importance, and this is especially true

when the cutting job involves a variety of sizes and shapes. The man who handles the cutting torch can save himself considerable time and cut the labor cost down to a minimum by looking over his job and deciding exactly what procedure is best to follow. A problem of this kind I encountered in a job illustrated by these photographs which show how we reduced the boilers in a puddle mill to charging box size with an



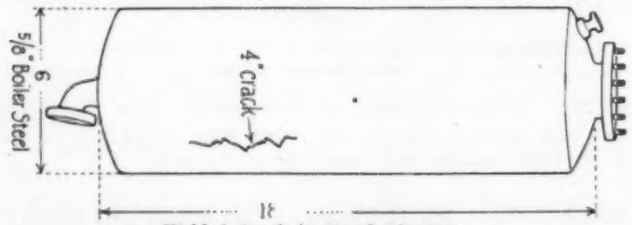
Demolition of Puddle Mill Boilers With Cutting Torch.

oxy-acetylene cutting torch. Our first step was to make the way clear by cutting away all the trimmings, and the next, to cut loose the tubes and staples. We cut the tubes by melting into them about the depth of the sheet. After the tube was cut ¾ths of the way around, we found that it could be knocked loose with a hand hammer. After all the tubes and staples were loosened, we cut out the heads by cutting around the boiler just back of them, then we split the boiler along the side from end to end. After this long cut was made we made five cuts which divided the boiler into sections 2½ ft. long. Five similar cuts were made on the under side of the boiler. The three middle sections were then cut on the side opposite the first cut, leaving the tubes separated by the end sections. When we cut the end section the tubes dropped, and this left half the boiler hanging. Then all we had to do was to cut the four hanging bolts and allow the tube half to drop on the cut sections and tubes. The frames were then cut loose and thrown over and cut into pieces 4 ft. long. In this way we cut all the boilers to charging box size.

WELDED CRACK IN LARGE TANK

By E. F. Hawkins

About two years ago I was called in to weld an 18-foot digestor, which had a 4-in. crack extending vertically in the shell. It gave some trouble but I finally managed to get the job done in a satisfactory manner so that it is still holding.



Welded Crack in Wood Digestor.

Therefore a description of it may be interesting to some other welder.

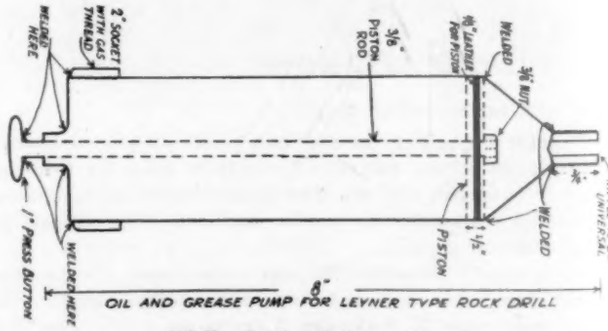
This digestor is used for cooking wood in a large paper mill. It is made of 5/16-in. boiler steel and measures 18 ft. in height by 6 ft. in diameter. This type of tank is particularly hard to weld in a satisfactory manner because in service it has to stand a great deal of expansion and contraction. In this particular case the plant runs day and night. These digestors are filled with chips and liquid, and 125 pounds of steam pressure turned in for at least ten hours. The pulp is then blown out to another department. The digestor cools for about a half hour and is then refilled and heated again. This goes on day after day. Expansion and contraction of this sort certainly puts a hard test on a welded crack.

The first time I tackled this job, I used an air hammer. I chipped out the crack and welded as well as possible from one side. This method failed twice. I chipped it out again and warmed the digestor as well as I could by turning in steam. After welding a short distance I took a hand hammer and packed the metal real hard while it was melting hot. This seemed to have a very beneficial effect because the digestor went right into service and is in daily operation now with the weld still holding.

WELDING CUTS PRODUCTION COST

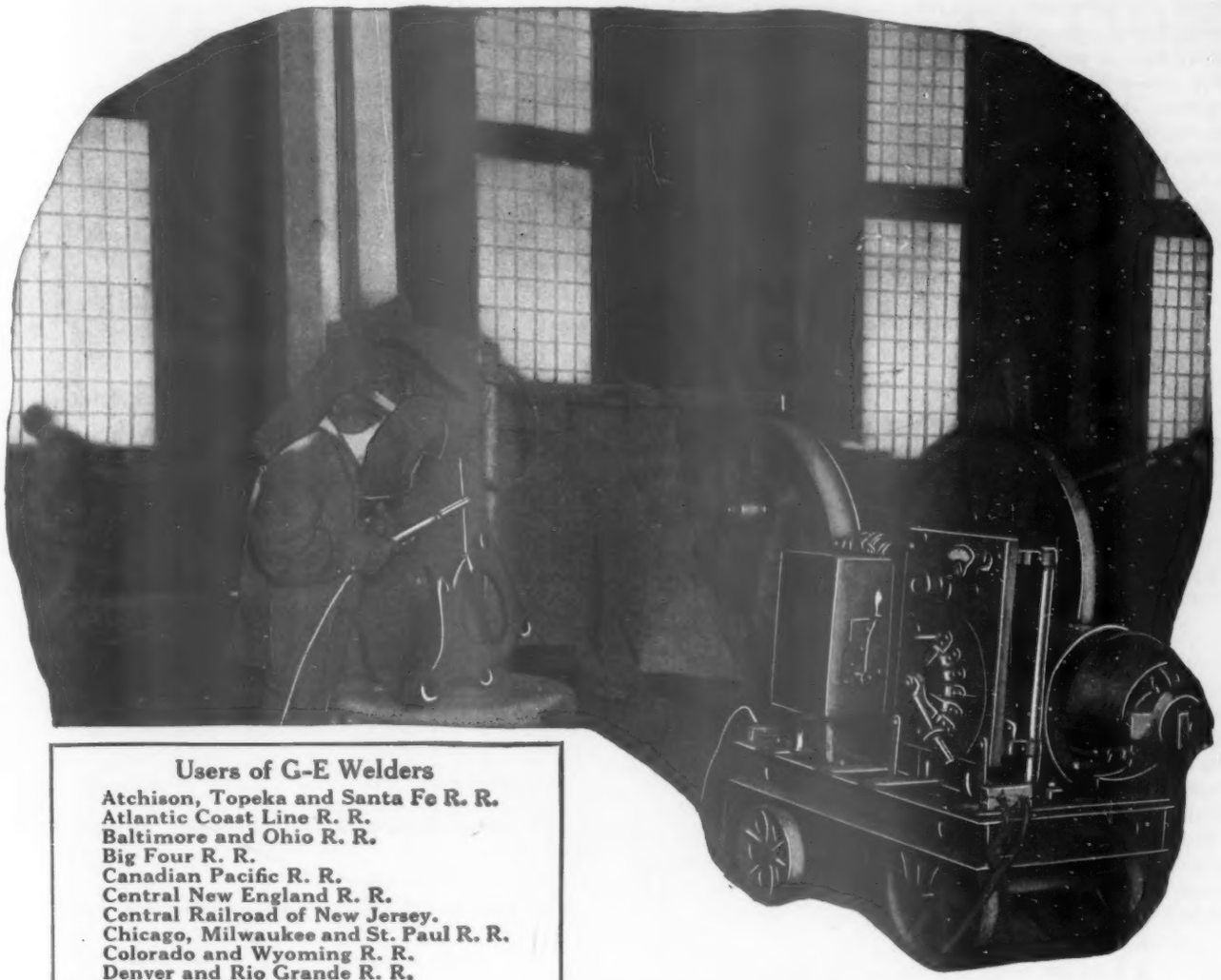
By J. W. Arnison

Welding is making possible quite a saving in the manufacture of grease guns which are used for the rock drills in the gold mines in South Africa. The first sketch shows how



Details of Oil and Grease Pump.

these grease guns are constructed and indicates what a simple welding operation is involved. The supply houses were making them out of solid material and furnishing them to the miners at such a high price that it was decided to cut the necessary parts and assemble them by electric welding. We



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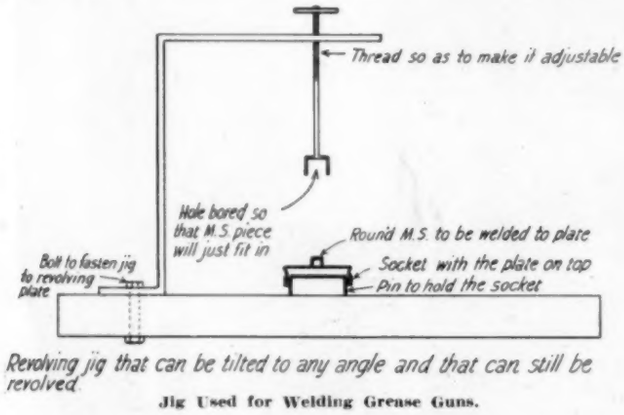
43B-796

found that we could make just as satisfactory an article at a much lower price. We ordered as many lengths of 2-inch water pipe as we needed and cut them to the required length in a power hacksaw, after which they were threaded in the machine shop. Then we ordered 2-inch pipe sockets which we cut into five equal pieces. Then we ordered the required number of lengths of ⅜-inch turned shafting for the piston rods, and cut them to the right length. Then we cut the cross-bar pieces for these rods. We have no punching ma-


Thread so as to make it adjustable
Hole bored so that M.S. piece will just fit in
Round M.S. to be welded to plate
Socket with the plate on top
Pin to hold the socket
Bolt to fasten jig to revolving plate
Revolving jig that can be tilted to any angle and that can still be revolved

Jig Used for Welding Grease Guns.

chine so we let the making of the round plates out on contract. The mild steel round stock was easily cut into required lengths and threaded. All this work was done before we started to weld, as we believe in having everything in good shape right at the start. We also constructed a jig which is illustrated in the second sketch because we found that it is worth while to have the proper holding devices when welding is to be done on a production basis. The actual welding was done with a ⅛-inch bare wire electrode. After welding the grease guns, they were returned to the machine shop to be finished off, and in service they proved very satisfactory.

A LARGE WELD AND A SMALL ONE

By George Reed

Some time ago I received a hurry call to a large manufacturing plant where the superintendent wanted to see what could be done with the header of a large box coil radiator, which had a 5-foot crack in its side as shown in Fig. 1. The metal was in very dirty condition because it had been out of use all winter. Evidently some water had been left in the header and I think that it froze and caused this crack.

What we wanted to do was weld it without disconnecting all the pipes and going to a lot of trouble in preheating. This coil was one of a set of four connected together and equipped with a large fan to blow the heated air through the pipes to different parts of the building. To dismantle it would be quite a task. My first attempt to weld the break failed, and this made it somewhat difficult to do the job over. On the first attempt the steamfitter disconnected this one section from the rest, lowered it on its side with the cracked side of the header on top. Of course we removed all the rust because rust and scale make good welding practically impossible. After making sure that all of the water was drained out we played a large oil burner on the header until it was cherry red around the crack. Then I started to weld using a ¼-inch square cast iron rod. While I was welding, a helper was playing the oil burner around the crack until the weld was finished. It looked fine until I put out the torch, then it broke immediately. It occurred to me that this was caused by contraction of the piece in the header, and it is reasonable to suppose that this was the case when you consider that there were hundreds of feet of cold 1¼-inch pipe.

We started in again, and this time had the steamfitter level this header in its present position and plug one outlet, leaving a ½-inch pipe to act as a discharge. We turned running water into the intake, filling the radiator just full enough so that the water would not sputter out through the crack. This was our reason for having the radiator set up "dead level." I used the next size larger welding tip and welded from right to left, the same direction in which the water was moving and reinforced the weld quite a bit. When I reached the end of the crack it was still holding and the last report I have shows that it has been giving good service ever since.

Figure 2 is a sketch of a broken phonograph crank. Three-

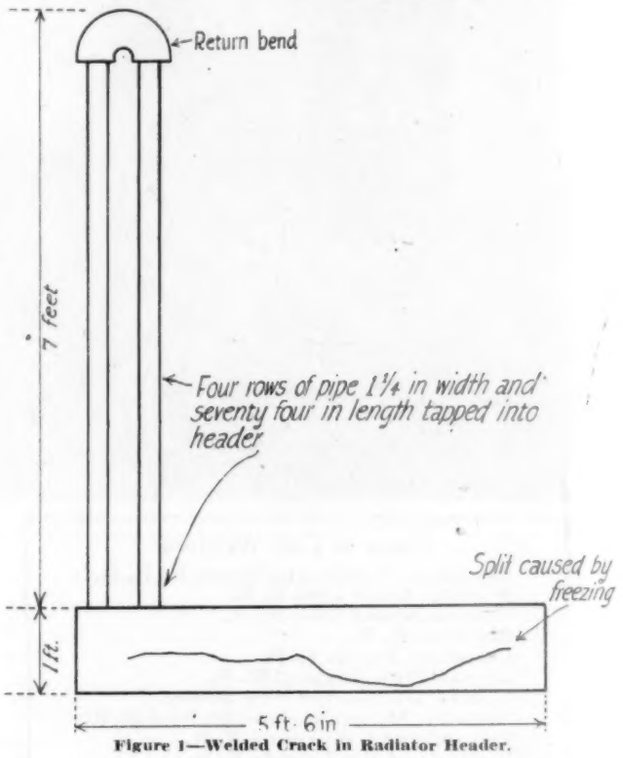

Return bend
7 feet
Four rows of pipe 1¼ in width and seventy four in length tapped into header
Split caused by freezing
1 ft.
5 ft. 6 in

Figure 1—Welded Crack in Radiator Header.

eighths inch had broken off the end. This was tapped with a bastard thread so it could not be drilled deeper and retapped a standard thread without making alterations to the spindle that engages it. At first I had hesitated about welding it because the material was so thin and there was danger of the threads inside becoming plugged with the metal. However I solved this problem by butting the broken piece to the main piece, endeavoring to place it in the exact position of the break,

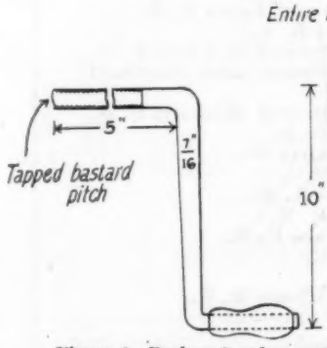


Figure 2—Broken Crank.

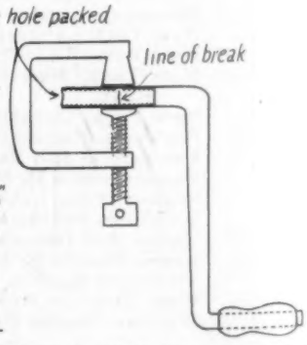


Figure 3—Lined Up For Welding

then taking a small clamp and clamping it sideways as shown in Fig. 3. I tacked it carefully under the clamping and over it. Then taking away the clamp I packed the hole tight with fused litharge, which I had mixed into a stiff paste with ordinary glycerine. Then I was ready to weld all around, and, of course, had to be careful to secure a first-class job on the first trial. I allowed this to cool on the welding table, then filed all around the weld to remove the surplus metal and finished up with number 00 emery cloth.

ARC WELDING in SHIP CONSTRUCTION

Welding Regulations Issued by Lloyd's Register of Shipping—Uses and Limitations of Welding in the Shipyard

By E. H. Ewertz†

How Welding Is Regulated

Circular No. 1374

Lloyd's Register of Shipping
71, Fenchurch Street London, E. C. 3.
12th June, 1922.

Dear Sir (s),

Reverting to previous circulars (Nos. 1227, 1314 and 1328) regarding the Society's requirements and practice in respect of Autogenous Welding, I am directed to inform you that the whole of the subject has been carefully considered by the Committee who have now adopted the Regulations set forth in the accompanying Notice No. 1373.

These regulations supersede the earlier circulars referred to above and I have to request that you will be guided accordingly.

I take the opportunity to send for your information in this connection the following general remarks:—

(1) As regards Ship construction only two vessels have been built under the supervision of this Society up to the present time in which Electric Welding has been used as a substitute for riveting entirely throughout the structure. One of these is a coasting vessel, 150 feet in length (M.V. "Caria" *ex* "Fullagar," 100 A1, Electrically Welded, Subject to Annual Survey—Experimental) and the other a harbor vessel, 50 feet long (M.V. "Esab IV", A—, For towing purposes on the West Coast of Sweden, Electrically Welded, Subject to Annual Survey—Experimental). So far as is known the results in these cases have been entirely satisfactory. Several other small vessels, including a ferry boat built in Japan, have been constructed in a similar manner, but no particulars are available in the Society's London Office. As regards parts of ship structures, welding has been adopted instead of riveting with good results in the fore and after peak tanks and other tanks intended for oil in the coasting vessel referred to above and has also been utilized in numerous cases as a means of securing oil tightness in seams of oil fuel bunkers and similar parts of the structure and has always achieved the object aimed at when the work has been executed properly.

(*See Regulations, par.* 1*a*.)

(2) As regards the shell plating of boilers it is to be noted that the Board of Trade requires (as per the Board's Circular No. 1596) that in no circumstances should any part of a boiler in a passenger steamer be welded if wholly in tension under working conditions, but that within limits, welding may be employed for repairing cracks in furnaces, combustion chambers and so forth, and in the same parts for reinforcing the edges of leaky seams.

(*See Regulations, par.* 2.)

I am, Dear Sir (s),
Yours faithfully,
ANDREW SCOTT.
Secretary.

Notice No. 1373.

Lloyd's Register of Shipping

NOTICE IS HEREBY GIVEN THAT THE FOLLOWING REGULATIONS HAVE BEEN ADOPTED BY THE GENERAL COMMITTEE REGARDING THE CONSTRUCTION AND THE REPAIR OF THE HULLS, ENGINES AND BOILERS OF VESSELS BY MEANS OF AUTOGENOUS WELDING.

1. *Hull.*—(*a*) If it is desired to employ welding in the construction of a vessel or in any member of a vessel's structure subject to severe alternating stresses, it is only permissible to use a system of electric welding which has been approved by the Committee as having complied with the "Tentative Regulations and tests to be complied with by all Systems of Electric Welding for which the approval of the Committee of Lloyd's Register of Shipping is desired," *see* page 3.

(*b*) Oxy-acetylene welding or electric welding may be adopted for the repairs of fractures to the shell plating at the ends of a vessel, or to stern frames and shaft brackets, where the workmen are known to be experienced in the use of these processes and the welding is carefully examined and tested on completion. Such repairs are only considered to be temporary, but may be accepted as permanent if, on examination after a sufficient lapse of time, they are found to be satisfactory.

(*c*) The following minor and non-structural items in vessels building to the Society's classification are not subject to restrictions regarding the system of welding which may be employed:—

Deck Rail Stanchions to Plating.
Fastenings for Detachable Rail Stanchions.
Joints of Continuous Railing Rods.
Attaching Deck Collars (L Rings) around Ventilators.
Attaching Deck Collars (L Rings) around Funnel.
Attaching Cape Rings.
Attaching Galley Fixtures to Plating.
Attaching Bath and other Fixtures in Officer's Quarters.
Attaching Cowl Supporting Rings to Ventilators.
Butts of Bulwark Rail.
Skylights over Galley.
Engine Room Skylight.
Engine Room Stairs and Gratings.
Boiler Room Stairs and Gratings.
Attaching Engine and Boiler Room Stairs and Gratings to Plating.
All Stairs and Ladders, including Rail Attachments.
Door Frames to Casings, Hinges, etc.
Clips for attaching Cleating to Casing.
Entire Screen Bulkhead.
Coal Shoots.
Butts of W. T. and O. T. Boundary Bars on Bulkheads or Floors in Double Bottom
Ventilator Cowls
Funnels and Uptakes.
Bulkheads (which are not structural parts of the ship).
Partition Bulkheads in accommodation.
Framing and Supports for Engine and Boiler Room Flooring or Gratings.
Cargo Batten Cleats.
Tanks (which are not structural parts).
Hand Rails on Exterior and Interior of Deck Houses.
Deck Houses not covering unprotected openings through weather decks.
Reinforcing and protecting angles around manholes.
Joints of W. T. Angle Collars at frames in way of W. T. Flats

(*d*) Welding as a means of repair of rudder stocks has not been approved

2. *Engines and Boilers.*—(*a*) Electric and oxy-acetylene weld-

*From *Marine Engineering*. *This is the concluding article of a series on "Applications of Arc Welding to Ship Construction," by Mr. Ewertz.*

†*General manager, Moore Plant, Bethlehem Shipbuilding Corporation, Ltd., Elizabeth, N. J.*

ing processes may be used for effecting certain repairs to the furnaces, combustion chamber plating, tube plates and so forth, and for filling in wasted places at these parts of boilers, subject to the restriction that the workmen are known to be experienced in the use of these processes and that the welding is carefully examined and tested on completion.

(*b*) Repairs by means of welding are not allowed for the shell plating of boilers, with the exception of the landing edges of the circumferential seams.

(*c*) Repairs by welding process to shafting, piston and connecting rods and so forth are not permitted.

Valve rods and eccentric rods, where reduced in diameter by wear, may be repaired by autogenous welding, provided the sectional area of the reduced part is not below that required and that the usual conditions with regard to such repairs are carried out to the Surveyor's satisfaction.

(*d*) Approval has been given in some cases to the repair of sole plates and columns of engines by welding, but all such proposals must first be submitted for the consideration of the committee.

(*e*) It is also permissible, to a limited extent, to employ welding to fill in surface defects in steel castings to provide sound surfaces for jointing at places which are not subject to stress. This concession, however, does not apply to flaws which may affect the strength or utility of the castings.

By order of the Committee,
ANDREW SCOTT,
Secretary.

71, Fenchurch Street, London, E.C. 3.
18th May, 1922

TENTATIVE REGULATIONS AND TESTS TO BE COMPLIED WITH BY ALL SYSTEMS OF ELECTRIC WELDING FOR WHICH THE APPROVAL OF THE COMMITTEE OF LLOYD'S REGISTER OF SHIPPING IS DESIRED

1. The cost of carrying out the required tests must be borne by the proprietors of the system of welding tested.

2. All test pieces must be prepared in the presence of a representative of the Society and all tests must be carried out under his supervision.

3. The steel used in the preparation of the specimens must be ordiary ship steel, having a tensile strength of from 28 to 32 tons per square inch.

4. The welding of all specimens must be executed in accordance with the company's usual practice.

5. A chemical analysis must be made of the metal of an electrode and the deposited material of a weld made by the same electrode.

6. A series of microphotos, magnification 100 diameters, must be prepared, showing the structure of the material of the weld, that of the plain plating adjacent to the weld, and that of the actual junction between the original and the added material.

7. *Tensile Tests.* Two sets of tensile test pieces with butt joints shall be prepared, each set consisting of specimens of different thickness, viz.:—¼", ½", ¾", and 1", together with a corresponding series of unwelded pieces. Each test piece shall be 24" in length by 3" in breadth, the breadth to be reduced to 2" for a distance of 6" on each side of the center. The surfaces of the welded joints must be machined so that the thickness of the specimen in way of the weld is not greater than that of the plain plate. The average tensile strength of the welded joints thus measured must not be less than 90 percent that of the unwelded plate.

In addition to the above, two specimens 20" in breadth and ½" in thickness, with tranverse butt weld, must be made, suitable for testing a 300 ton machine. In this case the surface of the welding need not be trimmed, but may be left slightly above that of the adjacent plating to the extent that would be adopted in actual practice. Small test pieces must be cut from the plain plate to determine its tensile strength. The tensile strength of the above butt welds should be about 90 percent of that of the plain plate.

8. *Modulus of Elasticity.* In order to permit the modulus of elasticity of the deposited material to be determined, two specimens shall be prepared from pieces of mild steel 25" in length, 3" in breadth, and ½" in thickness, by cutting out a central rectangle about 13" long and 1¼" wide, and filling this space with deposited material. These specimens to be machined to the usual test piece form, leaving a central portion, about 1" in width, of deposited material only.

9. *Alternating Stress Test.* A flat plate, ¾" in thickness, and 3 feet in length, to be cut through at a distance of 9" from one end, and the two pieces butt welded together. The plate to be then cut into longitudinal strips, 15 in number, ¾" in breadth, and these strips turned into round bars.

The bar to be tested will be fixed in a lathe running at about 1,000 revolutions per minute, and will be so loaded that a uniform bending moment is applied to that portion of the bar containing the weld. The loads to be adjusted so that for different bars the stress applied will vary from 12 tons per square inch to 6 tons per square inch, and the number of revolutions at which the bars break under each stress to be noted in order that a graph may be drawn.

At an applied stress of ± 6 tons per square inch the welded bars must be able to withstand approximately 5,000,000 revolutions.

10. *Impact Test.* Two specimens, ¼" and ½" in thickness respectively, to be prepared of dimensions 5' 0" x 2' 6", having a butt weld in the center parallel to the shorter edge.

The plates to be arranged on supports, spaced 4' 6" apart, placed parallel to the short edges of the plate and raised about 18" from the ground. The specimens should be able to sustain two successive blows from a falling weight as detailed below, without showing any sign of fracture of the weld:

Thickness of Plate.	Weight to be dropped.	Height from which weight to be dropped.
¼"	2 cwt.	9 feet
½"	4 cwt.	12 feet

11. The Committee may require, in any particular case, such additional tests as may be considered necessary.

Extract from the Rules for the Building of Steel Vessels

TENTATIVE REGULATIONS FOR THE APPLICATION OF ELECTRIC ARC WELDING TO SHIP CONSTRUCTON

GENERAL

Section 74. The following Provisional Rules have been adopted as a tentative measure for the classification in Lloyd's Register Book of vessels electrically welded, subject to the notations "Experimental" and "Electrically welded."

The approval of the Society will be given to any system of welding which complies with these Regulations, and consideration will be given to any alternative constructional arrangements which may be submitted for approval.

SYSTEM OF WELDING AND WORKMANSHIP

Section 75. 1. The system of welding proposed to be used must be approved and must comply with the regulations and tests laid down by the Committee.

2. The process of manufacture of electrodes must be such as to ensure reliability and uniformity in the finished article.

3. Specimens of the finished electrodes, together with specifications of the nature of the electrodes, must be supplied to the Committee for the purposes of record.

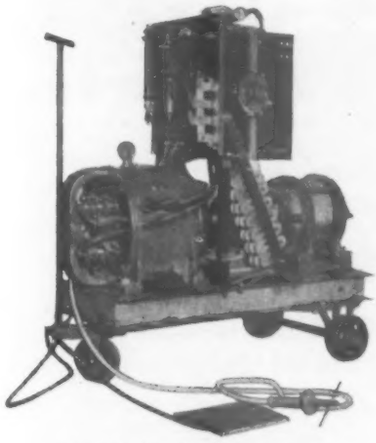
4. The Society's Surveyors shall have access to the Works where the electrodes are manufactured, and will investigate, from time to time as may be necessary, the process of manufacture to ensure that the electrodes are identical with the approved specimens.

5. Alterations from the process approved for the manufacture of electrodes shall not be made without the consent of the Committee.

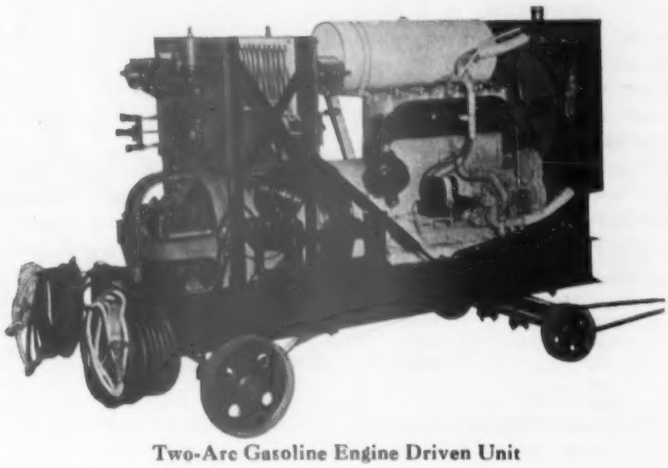
6. The regulations for the voltage and amperage to be used with each size of electrode, and for the size of electrode to be employed with different thicknesses of material to be joined, are to be approved by the Committee.

7. The Committee must be satisfied that the operators engaged

A Wilson Plastic-Arc Welder For Every Welding Need



Single Arc Portable Unit



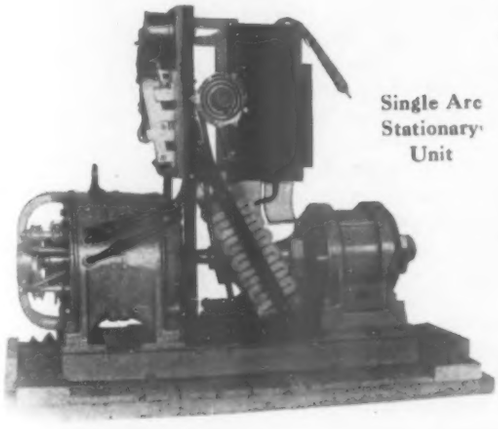
Two-Arc Gasoline Engine Driven Unit

Single Arc Belt Unit

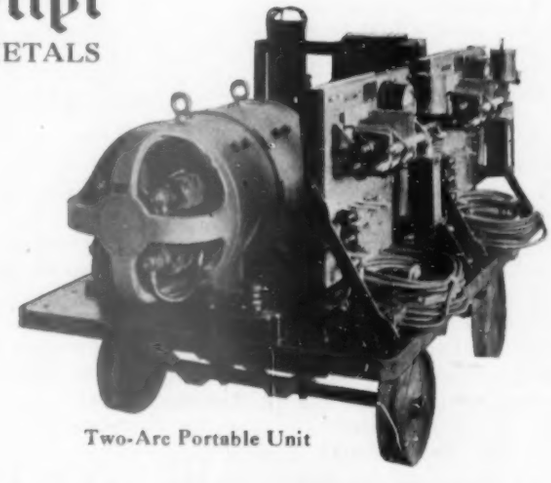
Wilson Welders
SPECIFY
Wilson "Color-Tipt" Welding Wire
FOR
Steel, Cast Iron, Brass Bronze and Monel Metal

Single Arc Gasoline Engine Driven Unit

WILSON
"Color-tipt"
WELDING METALS



Single Arc Stationary Unit



Two-Arc Portable Unit

WILSON WELDER & METALS CO., Inc., New York

are specially trained, and are experienced and efficient in the use of the welding system proposed to be employed.

8. Efficient supervisors of proved ability must be provided, and the proportion of supervisors to welders must be submitted for approval.

Details of Construction

Section 76. 1. The details of construction of the vessel and of the welds are to be submitted for approval.

2. Before welding, the surfaces to be joined must be fitted close to each other and the methods to be adopted for this purpose are to be approved.

3. All butt and edge connections are to be lapped or strapped.

4. With lapped connections the breadths of overlaps of butts and seams and the profiles of the welds are to be in accordance with the following table:

Thickness of Plate, Inches.	Width of overlap seam and butt, Inches.	Throat thickness, Inches.
.40 and under	2¼	.28
.60	2½	.38
.80	2¾	.48
1.00	3	.50

Intermediate values may be obtained by direct interpolation, and for thickness below .40 the throat thickness is to be about 70 per cent of the thickness of the plate.

5. A "full weld" extends from the edge of a plate for a distance equal to the thickness of plate to be attached, and the minimum measurement from the inner edge of plate to the surface of weld is the throat thickness given in the table above.

6. A "light closing weld" is a single run of light welding worked continuously along the edge of the plate. Such a weld may, however, be interrupted where it crosses the connection of another member of the structure.

7. An "intermittent or tack weld" has short lengths of weld which are spaced three times the length of the weld from center to center of each short length of weld. Such tack welding may vary in amount of weld between a "full weld" and a "light closing weld."

8. The general character of welds is to be in accordance with the following table:

	Inside edge.	Outside edge.
(a) Butts of shell, deck and inner bottom plating	F	F
(b) Butts of Longitudinal girders and hatch coamings		
(c) Edges of shell, deck and inner bottom plating	L	F
(d) Butts and edges of bulkhead plating		
	Toe.	Heel.
(e) Frames to shell, reverse frames to frames and floors	T	L
(f) Beams to decks		
(g) Longitudinal continuous angles		
(h) Side girders, bars to shell, intercostal plates, floors and inner bottom		
(i) Bulkhead stiffeners		

F = full weld, L = light weld, and T = tack weld.

9. All bars required to be watertight are to have continuous welding on both flanges with tack welding at heel of bar.

10. The welded connections of beam, frame and other brackets, are to be submitted for special consideration.

11. The committee may require, when considered necessary, additional attachments beyond that specified above, and the welding of all other parts is to be to their approval.

The following firms having applied to have their systems of Electric Welding tested to ascertain whether they comply with the Tentative Regulations adopted by the Society, the applications have been complied with, and the Surveyor's reports found satisfactory by the committee:

The Alloy Welding Process, Ltd.
The British Arc Welding Co., Ltd.
The Kjellberg System.
The Quasi-Arc Co., Ltd.
The Wilson Plastic Arc System.

List of Parts Welded at Union Plant of Bethlehem Ship-Building Corporation, Ltd.

That the shipbuilder and shipowner have taken advantage, at least, to a limited extent of the electric arc welded method for making joints can perhaps best be illustrated by giving a list of work now being done by one of our leading shipbuilders, Mr. J. J. Tynan, at the Union Plant of the Bethlehem Shipbuilding Corporation, Ltd., San Francisco, Cal.

Welding on Merchant Ships in Full or in Part

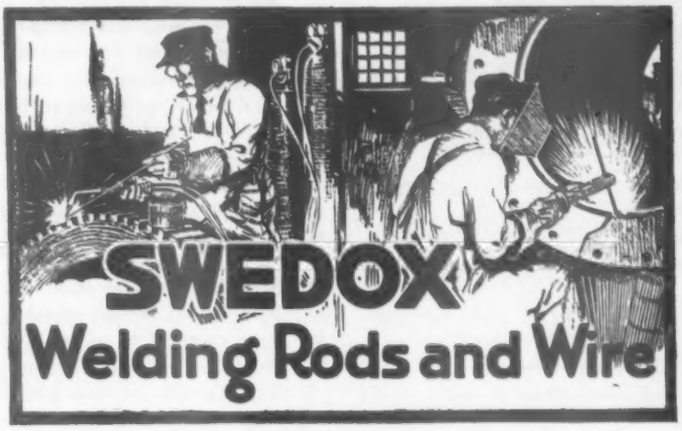
Deck rail stanchions to plating
Clips for detachable rail stanchions
Continuous railing rods (joints)
Attaching deck collars (L rings) around ventilators
Attaching deck collors (L rings) around smoke stack ventilators
Attaching cape rings around smoke stack pipes, etc.
Galley fixtures to plating (attaching)
Attaching bath and other fixtures in officers' quarter
Attaching cowl supporting rings to ventilators
Bulwark rail top splicing and end fitting
Skylights over galley
(a) Engine room stairs and gratings
(b) Boiler room stairs and gratings
Attaching (a) and (b) to plating grab rods on casing
All stairs and ladders, including rail attachements
Door frames to casing, hinges, catches, hold coach hooks, etc.
Clips for attaching interior wood finish to casing
Entire screen bulkhead. Also coal chutes
Butts of W. T. and O. O. boundary bars on bulkheads or floors in double bottom
Ventilator cowls
Stacks and uptakes
Bulkheads (that are not structural parts of the ship) partition bulkheads in accommodation
Framing and supports for engine and boiler room flooring or gratings
Cargo batten cleats
Tanks (that are not structural parts)
Shaft alley escapes
Steel skylights over accommodation spaces
Engine room skylights
Grab rods on exterior and interior of deck houses
Deck houses not covering unprotected openings through weather decks
Reinforcing and protecting angles around manhole
Joints of W. T. Angle collars at frames in way of W. T. flats

List of Welding on Destroyers

1. Cocoa matting cleats on deck
2. Lashing bolts for canvas awning deck
3. Clips for jack rods on galley house
4. Clips for ram-rods
5. Lashing pads for topedo tubes on deck
6. Clips for stanchions, engine and fire rooms
7. Boat chock on davits
8. Pipe and sockets for propeller guards
9. Clips for engine work bench
10. Sockets for hand rails
11. Cable hangers throughout boat
12. All fixture hangers throughout boat
13. Outlet box hangers throughout boat
14. Cable hooks in engine and fire room
15. Cable guards in engine and fire room
16. Battery boxes and brackets
17. Bulkhead clips for shelving, storeroom
18. Metal ceiling grounds, forward and aft quarters
19. Deck clips for battery lockers, all quarters
20. Bars to deck for metal joiner blkhd. No. 45
21. Boiler casings, corners
22. Bucket stowage, crew's wash room, galley
23. Pet cock guards, fire room
24. Miscellaneous deck clips for tanks and lockers
25. Collars on all ventilation trunks

NONOX SWEDOX
LEKTROX SWEDOX
GAS CARBOX
ARC CARBOX

VANOX
NICKOX
KROMOX
RAILOX
CASTOX



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SWEDOX welding wires and rods can be supplied immediately from stock, conforming in all respects to:

American Welding Society Specifications E No. 1-A; E No. 1-B; E No. 1-C; G No. 1-A; Folios No. 1-E and No. 1-G; and many others. We can furnish a welding wire or rod for any purpose and of any analysis required.

PUT YOUR WELDING TROUBLES UP TO US Let us prescribe the filler best adapted for your requirements. We maintain a research department conducted by experts for the benefit of our customers. This service is FREE OF CHARGE.

FLUXES—CASTOX, BRONZOX and ALUMINOX FLUXES when used with the corresponding non-ferrous filler rod will keep impurities out of the weld and promote thorough fusion.

FREE trial samples of any product will be furnished upon request. A trial of any SWEDOX product will convince you of its superiority. Send for these samples NOW

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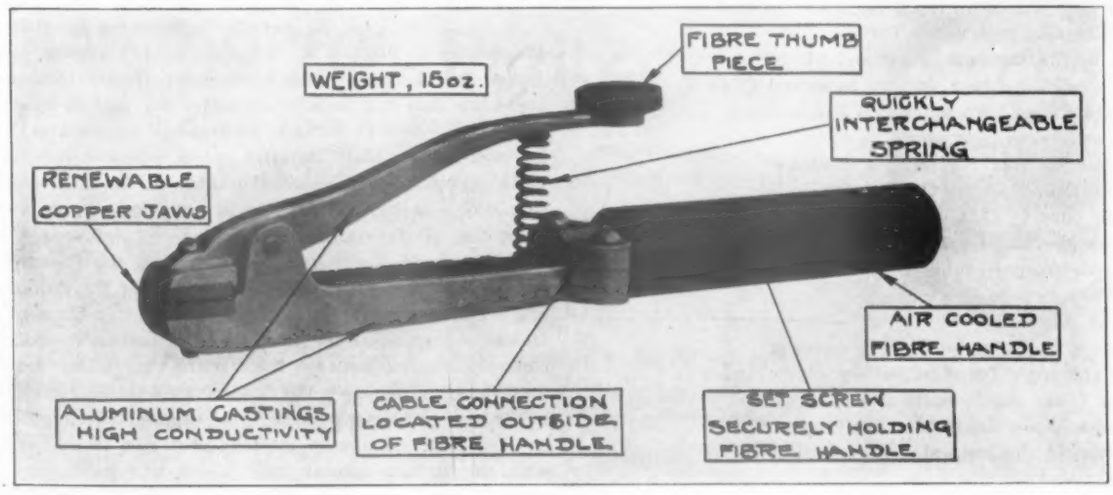
The ELECTRODE HOLDER
with the Qualities Appreciated by the Welder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QUICKLY INTERCHANGEABLE SPRING
RENEWABLE COPPER JAWS
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ALUMINUM CASTINGS HIGH CONDUCTIVITY
CABLE CONNECTION LOCATED OUTSIDE OF FIBRE HANDLE
SET SCREW SECURELY HOLDING FIBRE HANDLE

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DEALERS WANTED

Mfrs. Arc, Spot, Seam and Automatic Welding Equipment

26. Clips in paints and oils, provision, electric, galley, torpedo, for'd and aft magazine and construction stores
27. Air tight shoes to blkhd., around girder, at blkhd.
28. Trap seating, boiler rooms
29. Fuel oil tank pipe supports
30. Foundation for all discharge manifolds
31. All "T" bar clips for brackets over fuel oil tanks
32. All strainer seatings, boiler rooms
33. Clips on spare oil burner rack
34. Clips on coil racks, boiler rooms
35. Holder for boiler spare parts
36. Wire mesh under tiling in office 'WC, washroom and crews' washroom, after deck
37. Collars around deck beams in air locks to make air tight, boiler room
38. All seatings and hangers for fire extinguishers
39. Foundations and drip pans for lubrication oil tanks, boiler room
40. Clips on deck for transom
41. Pads on deck for mess table
42. Berth hangers for berths on frames, all quarters
43. Clips in radio rooms for furring strips
44. Berth supports to frames, all quarters
45. Clips in chart room floors
46. Flanges on ventilation pipe, crews' quarters
47. Spotting, flanges in position on main steam line, engine and fire rooms
48. Clips on gage boards to blkhd. in engine rooms
49. Brackets for gage board, fire rooms
50. Pipe hangers on blkhds. and tanks
51. Leader on deck for steering cable
52. Chocks under turbines and gear cases
53. Clips to tank top for lathe and grinding stones
54. Collars on vent recess at blkhd, under motor platform
55. All ladder clips
56. Hangers for operating rods
57. "Z" bars on blkhds.
58. Wash machine foundations, aft deck house, clips to deck only
59. Water way bars

LIST OF WELDING ON SUBMARINES

1. Angle bars to shell for blkhds. in superstructure
2. Ammunition storage boxes, all clips and butts
3. Ammunition storage boxes, all clips and butts
4. Forbes log installation trunk butts and corner
5. For'd trimming tank liners for zinc plate
6. Liners lubricating tank, for'd and aft blkhds.
7. Liners lubricating tank, battery room and C. O. C.
8. Foundation clips for ammunition boxes, locker, etc., for'd and aft battery room tank tops
9. All manhole cover foundations in tanks
10. Compass foundation C. O. C.
11. Flooring clips C. O. C.
12. Switch boxes foundation clips, for'd battery room
13. Clips under torpedo tubes
14. Foundation torpedo tubes
15. Bulkhead door butts
16. All clips in engine room flooring supports
17. Watertight angle butts on battery cover coamings
18. Conning tower hatch, butts and hangers
19. Ventilation pipes, flanges and shell supports
20. Exhaust pipe, flanges and bulkhd. collars
21. Torpedo doors

21 Picas Wide—8 pt. on 10 pt. Slug.

22. Radio room, clips for tables and cable hanger
23. Periscope, mast, hoist, foundations liners, C. O. C.
24. Telescope, radio mast foundations liners, C. O. C.
25. Toilet foundation
26. Miscellaneous alterations on foundations, holes, clips, etc.
27. Clips on hatch ladders
28. Pads on tank tops and blkhds. engine room
29. Fairwater angles and butts
30. Diving and steering gear foundations
31. Wrench stowage clips, blkhds. and frames
32. Motor room foundations
33. Butts on safes and foundations
34. Liners on shell for anchors
35. Skeg plate doubling
36. Horizontal muffler supports to shell
37. Expulsion tank cradle to shell
38. Cable foundations on aft ballast tanks
39. Switch board foundations
40. Clips in motor room for'd and aft blkhds.
41. All studs in for'd and aft fuel tank manholes
42. Steps, midship well
43. Steps, fresh water tank
44. Foundations for air starting flasks
45. Bow shutters, liners on hinges
46. Duct keel rubbing plate at frame
47. Tapping bars around gun foundations on superstructure
48. Clips on conning tower for connecting conning tower sheer frames
49. Tapping bars for doors on gun sponson
50. Bar for radio tube foundation
51. Stub masts, fairwater plates
52. Gun supports, fairwater plates
53. Support under superstructure at torpedo slide
54. Support under aft battery hatch
55. Support for thwartships blkhds.
56. Bars on escape hatches
57. Tapping bars on conning tower
58. Bats around radio tube at aft end of spray shield
59. Corners of cleat foundation plates
60. Liners on shell for stub masts
61. Liners on chain trough
62. Fill in around hawse pipe
63. M. V. blister steel covering to shell doubling
64. M. V. blister shell covering protector plate
65. Oscillater foundation aft bounding bars to shell
66. Patch plate in kingston plate, duct keel drain
67. Recess blkhd., butts on shoes, midship arrangement
68. Cleat foundation, flanged plates
69. Boat stowage chocks, angles to shell
70. Ammunition scuttle, heel of angle to cover plate
71. Angles to blkhd. and shell in M. V. sound room

Corrosion of Arc Weld Metal in Sea Water

A. G. Bissell, of the general engineering department of the Westinghouse Electric & Manufacturing Company, while at the Puget Sound Navy Yard, had an opportunity to examine many arc welds that had been in sea water for various lengths of time. In no instance was the arc weld metal corroded any more than the surrounding plate material except where it had been used to build up rivet heads on ships' rudders. Unwelded rivet heads in this same vicinity were also badly corroded. From a careful examination of the rudder of the U. S. S. *Arkansas* it was found that both welded and unwelded rivets on the forward end were corroded while a few feet along the side of the rudder were several welded rivets, none of which showed any signs of corrosion. It was concluded at the time that the corrosion was due to the electrolytic action between the steel of the rudder and the bronze propellers, the action being concentrated at the rivet heads.

The only information which the General Electric Company has on the ability of a weld to stand corrosion is that in connection with the 12-foot cubical tank which was made for the Emergency Fleet Corporation. This tank when completed was exposed to the weather for 5 years and a piece recently cut out of the side, which included a welded joint, showed that the depth of oxidation in the weld was just the same as on the plate, giving evidence that the welded portion is not any more susceptible to corrosion from ordinary weather conditions than the plate itself. The plate was ½ inch ship plate.

Why Welding Is Not More Widely Adopted

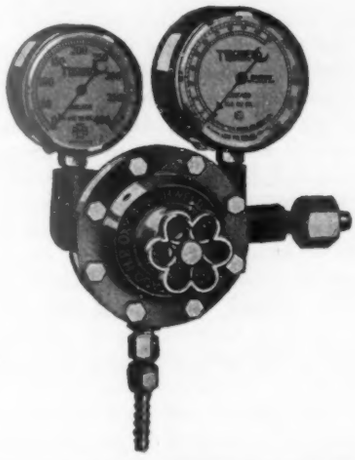
The reason for the relatively slow progress of the adoption of

(*Continued on page* 46)

You Can Do It Better With TORCHWELD

DISCRIMINATING BUYERS, in ever increasing numbers, are buying Torchweld Welding and Cutting Equipment to take care of their requirements in gas welding and cutting because their investigations and experience have proved conclusively that Torchweld Equipment gives them **FULL VALUE FOR THEIR MONEY.**

The New Torchweld Improved Gas Pressure Regulators have already established themselves by their showing in actual operation as being equal to Torchweld Welding and Cutting Torches in performance and dependability under the most severe operating conditions.



If you are not already acquainted with Torchweld Products and the reasons why their purchase will give you Full Value for Your Money and, at the same time, entire satisfaction from their use, send for our new big Catalog No. 23 and find out for yourself how Torchweld Products have earned for themselves their reputation of being AT ALL TIMES DEPENDABLE.

TORCHWELD EQUIPMENT COMPANY

224 NO. CARPENTER ST. **CHICAGO, ILL.**

HEYLANDT OXYGEN PLANTS

for producing oxygen by the air liquefaction process

99.2% Purity

during an eleven hour test

Heylandt

A satisfied customer is the best recommendation. One of our customers reports as follows:

"I can heartily recommend this equipment as I have used it for about a year and a half."

Every purchaser of Heylandt apparatus is a satisfied customer. You are invited to consult them for an opinion of their experience with it.

Some of the largest corporations in the United States, such as Armour & Co., Chicago, and the U. G. I. Contracting Company, of Philadelphia, use the Heylandt plant.

Three 30-meter plants in stock in America, ready for immediate delivery.

Excellent service with repair parts. A Heylandt expert engineer always at your disposal. Heylandt plants are also constructed for the production of nitrogen by the air liquefaction process. *For complete information write to*

Herman G. Amling **139 South 20th Avenue, Maywood, Ill.**
Phone: Maywood 2048

Minneapolis Office: G. A. LEONARD, 2933 4th Street, S. E.

French Women Excel in Light Welding

A Comparison of American and French Welding Shop Practice and Layout—No Overtime in these Shops

Paris, France,
Saturday.

Dear Ed:

They say that it is all in getting used to it. This applies to foreign countries just like anything else. After a fellow knocks around France for a while he becomes accustomed to their habits and the little differences which were so noticeable at first, lose some of their novelty. The foregoing applies to practically everything yet encountered with one exception. This is really a matter of no consequence, when you come right down to it, but it certainly is nerve racking so far as "yours truly" is concerned. I refer now to the everlasting squacking of auto horns. This may seem very funny to you, but in this wonderful city of Paris they seem to have thousands upon thousands of minature taxicabs simply crowding every boulevard. The boulevards are very wide, in some instances much wider than the famous "Michigan Boulevard" in Chicago. Imagine, if you will, a mob of say one hundred of these taxis coming down the avenue all in a bunch, squacking their horns like mad. If the horns were anything near as melodious as some of those we have in the States it wouldn't be so bad, but the ones they use are much like the little horns the kiddies had on their bicycles and give a squack which is very shrill. They are operated by a rubber bulb which is squeezed by the hand. Picture in your mind how it may seem to have a fleet of these cabs lined up at an intersection waiting for the gendarme to give the "go" signal, and everyone of them honking their horns like lunatics.

Had a queer experience the other day. Having met an Ohio boy, who is at present attached to the American Embassy here, it was but natural that I accept his kind offer to show me around a bit. I had heard about a large welding shop located at a small place just outside of Paris, so we headed for there day before yesterday.

After lunch we went out to inspect the shop. These French shops are much different from our American shops. On account of the older buildings and the different styles it is natural that such a difference should exist. This shop like so many others does not face on the street. Most of the shops are located in the interior of the block and must be reached through alleys, having but one entrance. There may be four or five "alleys" in a single block. These lead into sort of "courts" and around these courts are lined up various shops. In this particular welding shop it was surprising to note how many women welders were working. There seemed to be just as many women as men. After inquiring we learned the reason for this was because the women were more patient and painstaking on light repetition work than the men, whereas, the men were much superior on the large heavy jobs. Realizing this, the work was handled accordingly. Some of these women wore caps and others did not, the latter would let their hair mingle with the flame and the onlooker would expect momentarily to see the whole head enveloped in flames, but it seems they have very little trouble in this respect. Occasionally there is singeing, but no serious accident.

In this particular shop they used both processes of welding, oxy-acetylene and electric. They also had a machine shop and seemed to be catering to every type of welding imaginable, whether it was on a manufacturing basis or strictly job work seemed to make no difference. The machine shop was not separated from the rest of the shop. Everything was mixed in altogether and at first glance looked like a confused mass. This did not apparently bother the workers, for they kept right on going regardless of the layout. The electric machines were scattered around the shop and around each one was a small portable screen, which served as a protection to the rest of the welders, for it cut out all the harmful light rays which radiate from the arc. About half of the floor space was given over to a sand bottom, "a la foundry type" as it were. The other portion was laid with bricks. The acetylene gas was piped around the shop and behind each torch there was a water seal, as the whole installation was of the low pressure type.

There were several large cast iron jobs going through the shop. These were being preheated with oil torches and the procedure in handling them was slightly different than ours. In the first place instead of butting the fractured ends together and burning out with a welding torch, as is the common custom with us, they invariably beveled off their work before starting to weld. This, of course, takes much more time and naturally the larger the work the more time is consumed in this preparation. They use no asbestos paper or cloth; everything is sheet iron; and quite frequently this is the cause of very bad burns. In the actual welding, instead of heating the end of the filler rod and then dipping it in the flux can, it appears to be a common practice in this country to throw the flux on with the hand. The flux is used very bountifully. Instead of having small cans for flux boxes they invariably have a box made of wood, about one foot square and four or five inches deep, filled with the flux. To us it seemed very wasteful to have large quantities like this standing around the shop and being thrown on in this manner, but it is quite natural, as I stated before, that there should be many differences in the welding customs in various countries.

In most of the shops I have been in there seems to be considerable aluminum welding, and this case was no exception. Not only were aluminum castings being welded, but sheet aluminum articles were being fabricated. It seems to make no difference to the French whether it is castings or drawn sheets, they handle it with the same ease, for they are apparently "pastmasters" at the art of flux making and do some beautiful work with very little effort.

The only steel welding being done was in the lighter sheet metal class. Small parts were being manufactured and in this work the steel was exceptionally thin. It was here that the women were doing the welding and their procedure was quite interesting. In order to avoid warping and buckling of these thin parts, they were submerged in water and only the part to be welded was allowed to be above the water level. In this way, first a run of parts would be made with the weld on one side. On account of all the articles being the same, the water level and holder was naturally the same. When all these welds were executed the water level and holder was changed and another side welded. In this way the articles produced came out in first-class condition and from a welder's standpoint was a pleasure to behold.

It was not exactly pleasant to watch these women weld, for as I have above stated, it made me extremely nervous to see them bring their hair down so close to the flame. Our guide, who electric arc welding in ship construction is well explained by Mr. F. B. Webster, naval architect, in a paper read before one of our leading technical societies, where he states:

"Notwithstanding the advantages and merits of welding, this was showing us through the shop, spoke a little English so I asked him why they didn't make all of their girls wear caps. To which he replied:

"Ah! Women are all alike, they will have their own way. We can make them do nothing when it comes to caps."

"But I should think it would be dangerous," I said. "What if a spark should fly up or the flame chance to turn that way?"

"We have had no trouble, so we shall not worry about a thing like that until the time comes."

Such is the way in France! But really, Ed, a fellow sort of

STEEL WELDING CONTEST

In November the following announcement was made:

The UNITED STATES WELDING COMPANY, makers of "U. S." Oxy-Acetylene Welding and Cutting Equipment believe that steel, although welded extensively, presents more difficulties to the average welder and is less understood by him than any other metal in common use. Too many operators are satisfied with external appearances and overlook the most important point of THOROUGH FUSION. In order to stimulate interest and furnish an incentive for these welders to examine and improve their own work, thereby raising the standard of welding, the UNITED STATES WELDING COMPANY offers a cash prize of $100.00 for the best Oxy-Acetylene Weld made in steel plate and submitted for examination before March 1st, 1924.

Since the purpose of this offer is to elevate the standards of welding, contestants will be limited to those actively engaged in welding.

CONDITIONS

1—Contestants must be men who are actively engaged in welding. Salesmen, Demonstrators and Instructors are not eligible for this competition. It is, however, open to Shop Owners who do some of their own work; Foremen who spend part of their time in actual welding, and Supervisors who spend a part of their time in actual welding.

2—It is desired to standardize upon the size of samples as much as possible without making the selection of stock too difficult. Each of the two pieces to be welded together should be ½ in. thick, 3 in. wide and 6 in. long. These dimensions are the minimum limits. Slightly larger stock can be used. The ends of these parts are to be butt welded so as the cross section of the weld when broken will be ½x3 in. The weld must be made from ONE SIDE only and left flush with the surface. Do not reinforce. Contestants may select their own stock, filler rod, pressure, etc.

3—While each contestant is limited to one sample, he may make as many samples as he desires in his own shop and submit the one which he thinks will represent his best efforts. The contestant must break his own sample THROUGH THE WELD. Retain one-half for identification and send us the other half.

4—The Coupon below,* or a similar form, must be filled out IN FULL and accompany the sample. (Do not paste coupon to sample.)

5—All pieces submitted must reach our office by noon, March 1st, 1924. No deposit or fee is required, nor is the contestant under any obligation whatsoever.

*The coupon referred to calls for the following information: Name and address of contestant; date; name of employer; make of torch used; make of acetylene used; make of oxygen used; make of filler rod used.

The purpose of this contest, as then explained, was to create an incentive for welders to test and improve their own welds, for according to the conditions, every weld had to be broken through the weld itself, before submission.

The results thus far have been very gratifying. The contest has stimulated much more interest than was ever anticipated. On account of the numerous requests for criticisms which would help the welder overcome his failings, it has been decided that during the remaining few weeks of the contest, any welder who accompanies the weld he sends in, with a stamped return envelope, will have his weld criticized and receive suggestions for overcoming any apparent weakness.

Remember: Contestants incur no obligations; Every welder is invited to participate.

UNITED STATES WELDING CO., Inc., Minneapolis, Minnesota

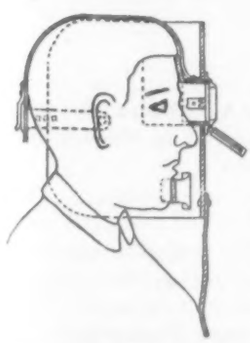
(Makers of famous "U. S." Welding and Cutting Apparatus)

Perfect Protection

assures

Confident Operation

The Ideal Face Shield protects the arc welder from direct and reflected rays, and at the same time fits the operator so comfortably and so securely that he can give all his attention to the manipulation of the arc. This shield is made of vulcanized fibre and aluminum and is so constructed as to rest entirely upon the head; giving the operator the free use of his head and arms at all times.



The hinged door allows quick removal or change of the colored glasses without the use of tools. Back of this door is an inner glass which protects the eyes when the operator opens the door to inspect his work. Notice the rigid adjustment illustrated at the left. This keeps the glass always in line with the eyes and the parts being welded, regardless of the position of the work.

Welding Glass for Ideal Face Shields, in lots of 10 or more **$1.25 each.**

The Ideal Face Shield has given perfect satisfaction in all shops where it has been used. You'll like it too after you have used it.

Price $9.00

Manufactured and Sold by

THE IDEAL FACE SHIELD COMPANY

468 N. Garfield Ave., Columbus, Ohio

likes the country and their customs after he becomes better acquainted with them. They certainly do know how to live. Money is not their whole idea of living. At twelve o'clock noon they knock off for lunch and take two hours. This means that all business is stopped and all the shops locked up between twelve and fourteen o'clock. It may seem strange for you to hear "fourteen o'clock." In our way of measuring it would be two o'clock, but over here they do not divide their day and night into two periods of twelve hours each like we do. They go right straight through. When they say "twenty-three o'clock," they mean eleven o'clock at night.

Well, Ed, my cash has been holding out pretty good, but I understand that a dollar goes much further over in Germany than it does here, on account of the rate of exchange. This being the case, methinks I'll hie myself to Germany next, so if the next time I write you I am located over near Berlin, don't worry, there will be method in my madness.

Kindest regards, SHEP.

ARC WELDING IN SHIP CONSTRUCTION

(*Continued from page* 42)

art has not been adopted in shipbuilding to anywhere near the extent hoped for by its advocates. To some extent this is undoubtedly due to the fact that the executives in a shipyard are more or less influenced by men who do the work, and these men are more or less uninformed about welding or prejudiced in favor of old methods. The shipowners are also very conservative when it comes to trying anything new which in their judgment might affect the safety of a ship at sea.

"The real cause, however, that is delaying the adoption of welding in the strength members of a ship, lies in the present method of design. The modern ship with its angle bars and other shapes is designed for riveting and the faying surface of most of the flanges of these bars serve no other purpose than to provide a means of riveted connection. With riveting a calking edge is, of course, necessary and the toes of the bars often serve for this purpose, but in welding the calking, as well as the connection, is in the weld. Before the art of rolling shapes was discovered, ships were entirely constructed of plates and flat bars, and the flat bars were held in place perpendicular to the plating by straps spaced at frequent intervals.

"If the strap is removed and the junction of the bar and plate welded we have a section that is as strong as an angle bar plate connection with a more symmetrical neutral axis. Where something stronger than a flat bar and plate section is required the toe of the web of a T-bar or flanged plate, or the toe of the flange of an angle bar may be welded to the plate. This is but one indication of a type of efficient welded construction, but its importance is obvious when the amount of weight that can be saved by the omission of faying flanges and also the beveling of these flanges in the curved portions of the ship is taken into consideration.

"Another custom and prejudice to be overcome is the overlapped and strapped joint. We have seen from the tests described above that the butt joint is the strongest, both for tensile strength and alternating stresses, but in spite of this Lloyd's require the lap joint. The lap joint is not only weaker, but it is a positive menace.

"Where there is such difference in the means of fastening as exists between welding and riveting, it is but natural to expect that the method of construction for one type is not suitable for the other. And, in spite of the fact that welding used in the construction and repair of locomotives, in the repair of marine boilers and in the construction of the all-welded vessels already built, has shown that this method of fastening is reliable, the use of welding in ship construction will not reach its proper development until the designs of ships are modified to suit its characteristics.

"Whether the future designs for the all-welded ship are along the lines indicated above or not is immaterial, but the advantages that welding possesses are sure to increase its use in the marine field, and the thing most needed to hasten this development is an approved and efficient method of welded rather than riveted ship design."

In conclusion, the author wishes to express his gratitude to all those who furnished papers, data, etc., in connection with this paper, and also to Mr. H. M. Hobart, consulting engineer of the General Electric Company, Mr. W. Spraragen, secretary, division of engineers, Welding Research Committee, and to the author's son, Harold M. Ewertz, for the assistance they have given in the preparing of this paper.

FLUXES AND THEIR FUNCTIONS

(*Continued from page* 23)

In the furnace, the atmosphere—reducing or oxidising as required—and the temperature of the metal, are under control; the time during which the metal and the flux or slag are in contact may be minutes or hours.

In arc welding the metal passes from a temperature much higher than that of any furnace to the temperature of solidification in a few seconds as a maximum. The reactions must therefore be very rapid. The high temperature doubtless favours rapidity, but the reactions may not be similar.

We have had to discover for ourselves the flux compositions to give the desired results, and they are not at all what a steel maker aiming at the same final composition of steel would use.

Besides the desired composition of the weld metal a flux covering has to satisfy other requirements. Those of a mechanical nature have already been mentioned.

The covering must not melt too easily or it will run off the metal, leaving bare metal for some distance from the arc, and will not get to its proper place as slag.

It must not have too high a melting point or it will "cup," project beyond the fusing end of rod and embarrass the operator by deceiving him as to the arc length.

The covering should fuse level with the rim of the crater of the rod. Electrodes for "overhead welding" have to be specially made.

One which works quite well with the work undermost may behave very badly where the work is above.

We have had to develop electrodes for overhead welding by a long and ultimately successful process of experiment.

News of the Welding Trade

C. L. Bastian, of the Bastian-Blessing Co., Chicago, is on the way to California for a winter vacation trip.

The Bastian-Blessing Company, formerly located at Austin Ave. and LaSalle St., Chicago, is now getting settled in the new factory at 240 E. Ontario St., Chicago.

The K-G Welding and Cutting Co. is now represented in Canada by the Welding & Supplies Co. of Montreal, and the Welding & Supplies Co. of Toronto.

"Uses Cutting Torch on Oxygen Cylinder—Now Welding Broken Harps," is the headline of a news item appearing in a recent bulletin of the Gas Products Association. The item tells how one man attempted to burn a name on a charged oxygen cylinder with a cutting torch, with tragic results.

M. Keith Dunham, Chicago, recently completed the installation of an air liquefaction oxygen producing unit in the plant of the Simmons Company, Kenosha, Wisconsin.

The plant of the Minnehaha Welding and Machine Co., 3750 Minnehaha Ave., Minneapolis, Minn., is soon to be enlarged to the extent of a two-story addition which is to be used as a machine shop.

Scott Wade, of Acetylene Products Co., Indianapolis, was a visitor in Chicago the first part of this month.

It is reported that the Air Reduction Sales Co., New York, has plans under way for the construction of a new large plant at Harrisburg, Pa.

S. E. Dibble, head of the Department of Heating, Ventilating and Sanitation at Carnegie Institute of Technology, Pittsburgh, has recently been elected first vice-president of the American Society of Heating and Ventilating Engineers. Mr. Dibble has had charge of the welding instruction in Carnegie Tech. for some time.

A new shop for gas and arc welding, known as the Phoenix Welding Company, has been opened at 389 Montgomery Street, Jersey City, N. J. H. A. Huff is the proprietor. The shop is equipped for all kinds of commercial repair and boiler welding.

The February meeting of the American Welding Society, Chicago Section, was held Friday evening, February 1, in the rooms of the Western Society of Engineers. Henry S. Mann, district manager of the Metal and Thermit Corporation, read a paper on "Thermit Welding and Its Uses." K. Llewellyn, of the National Tube Co., then read a paper on "The Manufacture of Oxygen Cylinders," which was illustrated by lantern slides and motion pictures.

W. R. Noxon has been appointed general sales manager of the Burdett Mfg. Co., Chicago. Mr. Noxon is well known to the welding industry through his former connections with the Davis-Bournonville Co. and the Alexander Milburn Co.

A. J. Peters has recently opened a new job welding shop at Harrison, Ark.

Smith's Inventions, Inc., Minneapolis, are announcing a new Smith product, called the Utility Heater, which uses acetylene as fuel and may be used in connection with a generator or tank. It takes up little space and may be used for melting lead or babbitt or heating soldering irons.

During the recent automobile show in Milwaukee, Sam Smith, of the Universal Oxygen Co., received honorable mention in the Auto Show Special number of "Inside Dope" as follows:

"Here's a tip for the guys that are solemn supporters of the Volsteadian theories: The fellows in the Universal Oxygen booth, down in Machinery Hall, have no more respect for the prohibition laws than a Mexican lizard has for a plugged peso.

"Anybody who wants a drink can get it in this booth. Just ask Smith or his cigar smoking assistant and you can get it. Wine or liquor as freely as molasses in sub-zero weather. They have the glasses 'n'everything. Don't forget to wet your whistle at the Oxygen booth. They are the most accommodating gang of grifters at the auto show. We've been there, and speak advisedly."

Hans Mueller, president of the company, hastens to explain that this all concerns demonstrations of liquid oxygen.

Classified Ads

Help Wanted—75c per line, minimum 4 lines.
Jobs Wanted—4 lines free.
Other Ads—$1.00 per line, minimum 4 lines.
Counted 8 words to line. Add 6 words for keyed address

Position Wanted—Welding engineer, familiar with all oxy-acetylene welding applications, now employed as head of large welding department, desires change. Capable of taking complete charge of welding on large scale. Willing to travel. Can furnish proof of ability. Address 21, care The Welding Engineer.

Wanted to Buy—Second hand Black & Decker ½-inch electric drill. Herman Lambrecht, Sullivan, Ill.

For Sale—Welding shop in a city of 100,000. Doing good business. Reason for selling, bad health. Bargain if sold at once. Service Welding Co., Evansville, Ind.

Veteran Wants Job in Northern City—Ex-marine, partially disabled in service, must move north for health. Experienced in auto, job shop and railroad work. Now in charge of important department. Knows gas, arc and thermit processes. Best references from present employer. Address 22, care The Welding Engineer.

For Sale—Santa Barbara, California's only welding shop. Equipped with modern electric and acetylene welding apparatus and machine tools. For information write The Welding Engineer or L. F. Amort, Santa Barbara, California.

Position Wanted—Competent electric and oxy-acetylene welder desires position with some up-to-date welding company or oil company. Experienced in all lines of work. Best references. Address 23, care The Welding Engineer.

Wanted to Buy—Standard make, used electric welder. Must be in good condition. M. C. Thurston, 1542 E. Cary St., Richmond, Va.

Wanted—Man with real sales experience in the electric welding field, capable of demonstrating all makes of arc welding machines. Must be a producer, and willing to travel. Address 25, care The Welding Engineer.

A WELDING ROD HOLDER
For the Oxy-Acetylene Welder
If you are selling welders' supplies, keep a few welding rod holders in stock. There is a growing demand for this handy tool.
Write for Prices and Samples.
C. SORENSEN
18 E. 19th Street, Chicago, Ill.

If you own an electric welder—

you need a

"WODACK" Special Grinder

Do you know that "WODACK" Portable Electric Grinders can be furnished with special windings to operate directly from your welding machine? The photograph above shows one of these special grinders in use. We can also furnish "WODACK" Portable Electric Drills for welding circuit. You don't have to install and operate expensive air compressing machinery to give your customers smoothly finished welds. Write for details about the "WODACK" Welder's Special Grinder, and we will tell you how to give your customers better work at a reduced cost.

WODACK ELECTRIC TOOL CORP.
43 So. Jefferson Street CHICAGO, ILL.

U. S. GAUGES

The difference between a gauge and a "U. S." gauge is the difference between a standard which may be lowered to fit a condition, and a standard which must be upheld to fulfill a reputation.

U. S. GAUGE CO.
44 Beaver St., New York

PRESSURE GAUGES VACUUM GAUGES

SALLWELD
ASBESTOS PAPER

SAL-MO PRODUCTS
Trade Mark

In rolls 36 inches wide weighing approximately 100 pounds each.

SLOWS UP COOLING PROCESS

No obnoxious or injurious fumes.

KEEPS DIRT OUT OF WELD.

Manufactured by
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CURRENT WELDING LITERATURE

WELDING AND CUTTING IN FREIGHT YARD REPAIRS, by H. W. L. Porth—Limitations imposed on welding by American Railroad Association Rules—Necessity for welding and conditions under which welding must be performed—Necessity for high ductility, high tensile strength and high elastic limit—Necessity for having good workmen if good work is to be expected—Method of welding cast steel truck sides—Truck bolsters are preheated before welding and reheated after welding—Welding axles—Welding spring planks—Cutting in connection with car repairs.—Railway Mechanical Engineer, February.

OXY-ACETYLENE MACHINE WELDING, by F. E. Rogers—The application of automatic machines and single and milti-flame torches to production—Progressive welding of tubes without filler rod—Special tube and shape welding—Corner welds—Welding of plates and drums without filler rod—Method of preparing sheets—Progressive welding twih filler rod—Simultaneous or compression welding.—Acetylene Journal, February.

OXY-ACETYLENE WELDING AND CUTTING IN THE MINING INDUSTRY, by Herman Ullmer—The application of the process to repairs, maintenance and salvage in mining plants—Indications that the process is more valuable to the mining men in a great many cases than it is to the average manufacturer, on account of the distance from the source of supply. The importance of having a well equipped welding shop—Use of the torch for cutting cast iron in mining work.—Acetylene Journal, February.

TRAINING WELDING OPERATORS—A description of the courses in Gas and Electric Welding given at the Cleveland School of Technology. Since 1922, 156 Gas Welders and 42 Electric Welders have been trained in the school; the average course of instruction taking 65 hours. Accomodations are provided for 12 gas welding students and one electric welding student in each class. Some of the practical work is given under actual shop conditions. Sixty per cent of the graduates are said to have stuck to the welding trade after leaving school.—The Iron Age, February 7th.

OXY-ACETYLENE TIPS—Monthly publication of the Linde Air Products Company. The February issue contains the following articles: Shearing Time and Money Costs—The use of Old Naval Shells For Oil-Well Tools—A Sheet Metal Specialty Shop—Preventing Storge Tank Leakage—Profit in Small Part Production Welding—Planning and Constructing an Oxy-Acetylene Welded Pipe Line—Welded Shoe Dies Are Cheapest—Jigs Simplify Welding of Automitive Parts—New Lines for All Shops.

SMITHOGRAMS—Monthly publication of the Smiths' Inventions, Inc.—January issue contains a discussion of Steel Welding, which describes the characteristics of steel, the importance of proper flame adjustment, the selection of the proper tip and welding rod, detailed instructions for making a weld, covering the preparation of the parts, application of the heat, and the addition of new metal—A slight reinforcement is recommended. Recommendations for getting rid of hard spots.

WELDING LOCOMOTIVE TIRES—A report of an investigation to determine the effect on the strength of the material produced by local heating when building up worn tire flanges. The report seems to be rather unfavorable to welding, but at the same times indicates that the investigation was not as thorough as it might have been, as quite a number of important factors are missing. The name of the railroad making this investigation is not given. The conclusions reached can scarcely be taken as an indication of the advisability or inadvisability of welding flanges.—Railway and Locomotive Engineering, January.

ACCURATE CUTTING ON CAST IRON—A description of a cast iron cutting job recently accomplished in connection with the moving of a seven-story building.—Industrial Gases, London, December.

WELDING STELLITE WITH THE OXY-ACETYLENE TORCH, by Herman Ullmer—A reducing flame is used to prevent overheating, but a larger tip is also used. Parts are preheated, if possible. The welding of Stellite to steel or cast iron is the most frequent type of weld. A small amount of flux is necessary. The steel should not be actually melted under the torch, but brought to such a temperature that the stellite will just flow on it, then the flame is directed at the end of the filler rod, which is held still and not used to stir the molten metal.—Industrial Gases, London, December.

LARGE GAS HOLDER FABRICATED BY OXY-ACTTYLENE WELDING, by G. O. Carter—A description of the construction of tanks 53 ft. in diameter by 26 ft. high—Methods of handling the material—Devices employed to take care of expansion and contraction.—Industrial Gases, London, December.

LITTLE TRICKS OF A BIG TRADE, by David Baxter—Carbon blocks used to save holes when welding—Using welding rod as a handle for a patch—An electric fan to cool the operator—Cleaning a gear by burning grease and brushing with a wire brush—Cleaning files with a piece of brass tube.—American Blacksmith and Motor Shop, January.

THE OXYGEN LANCE IN BLAST FURNACES AND STEEL PLANTS—Loose-leaf pocket size book published by the Linde Air Products Company. Describes the Oxygen Lance and its operation—The blast furnace plant—Opening an iron notch—Emergency versus routine tapping with oxygen—Opening a slag notch—Re-opening frozen tuyeres— Drilling salamanders—Breaking us spills and ladle skulls—The open-hearth furnace—Tapping a steel furnace—Tapping an open-hearth furnace with oxygen as routine practice—Opening frozen stoppers in steel ladles—Pipe lay-outs for furnace plans.

RECLAMATION ON THE SOUTHERN PACIFIC, by E. J. Becker—A summary of the savings effected by reclamation of scrap material in the shops of the Southern Pacific Railroad.—American Machinist, January, 24th.

RECENT DEVELOPMENTS IN WELDING METHODS, by Wm. Sprargen—Arc welding cast iron—Arc welding of steel stuctures—Arc and gas welding of tanks and pine lines—Improvements in machines.—American Machinist, January 17th.

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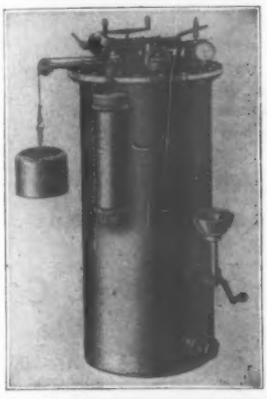

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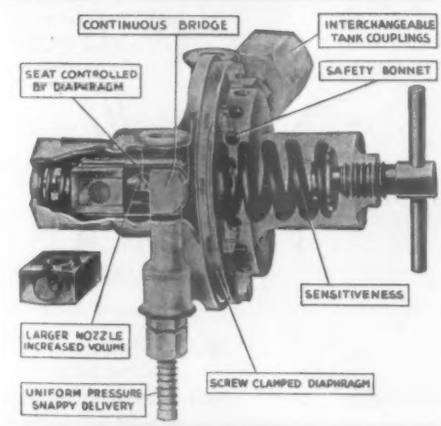

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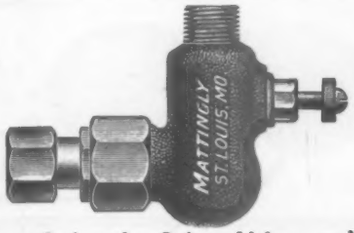

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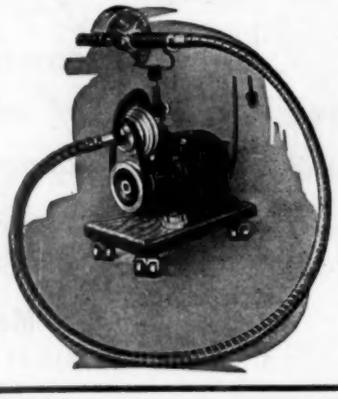

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W. D. Baugh, of the Greenwood Welding Works, Greenwood Miss.—"Propaganda put out by all Acetylene supply men (Salesmen) about the glaring (?) faults of arc welding generally, has kept me out of the market for two years, and I only decided to buy when I saw your 'AD' in the Welding Engineer, that motor blocs could be welded on the car, etc., and I bought it for that purpose alone, although I am happy to say that my machine is handling 50 per cent of the work I used to do with gas and the cost is too little to add on to the price. As buying your machine has really brought me real and lasting prosperity, I am more than glad to do all I can to further your interests."

Mr. L. A. Hacker, of 529 N. Main St., Vernon, Texas.—"I pay $5.00 minimum power bill with the installation of your machine and the bill runs from $4.50 to $8.00 per month at my shop, and I do all the work possible with this machine. I do more than two-thirds of the welding with my electrical machine, and if it were not for cutting with gas, I could almost dispense with my old tools. Of course, I weld aluminum with gas also, but most of my work is done with the electric, and the bills average under $6.00 a month. My bills for gas used to run from $60.00 to $80.00 a month, and the electric machine has reduced it to that amount. (After using our machine eighteen months, he has made enough money to build a brick building and he voluntarily states it is practically due to the advent of our apparatus). Also, your machine is the best ever, and I would not part with it under any circumstances."

Mr. Rabold, of the Metals Welding Co., Wilkinsburg, Pa.—"Enclosed please find check for $50.00 as final payment for Electric Arc Welder as per contract. We take this opportunity to thank you for the courtesy extended and wish to state that we are very well pleased with our machine thus far. Its usefulness becomes more apparent every day and the results we are able to obtain are very satisfactory."

Mr. Talkowsky, Manhattan Welding Co., 11 Sixteenth Ave., Newark, N. J., says: "I will never touch the gas torch again. I can get just as good results by preheating and using electric where preheating is necessary and for most of the jobs there is no preheating."

Mr. R. E. Greenway, Electra, Texas, writes: "I have had a chance to turn out several jobs and that has been highly superior to an Acetylene and the time and heat cost has been so much in favor of the electric arc, that there is no comparison. It looks to me as if the electric bill of $6.00 or $8.00 would replace the gas bill for the same work of $60.00 or $80.00 a month."

Libby Welding Co., of 115 Frelinghuysen Ave., Newark, N. J., who have two of our machines and have just built a new brick and steel building of their own, write as follows: "With reference to your request as to the proper welding equipment for an up-to-date welding shop to meet the demands of general welding, would like to say that with the exception of brass, copper and aluminum, we at all times use your Alternarc electric welding machines.

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Mr. E. R. Randal, Lewiston Welding Co., Lewiston, Maine.—"My machine has never given me one minute's trouble since I purchased it March 21, 1922."

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